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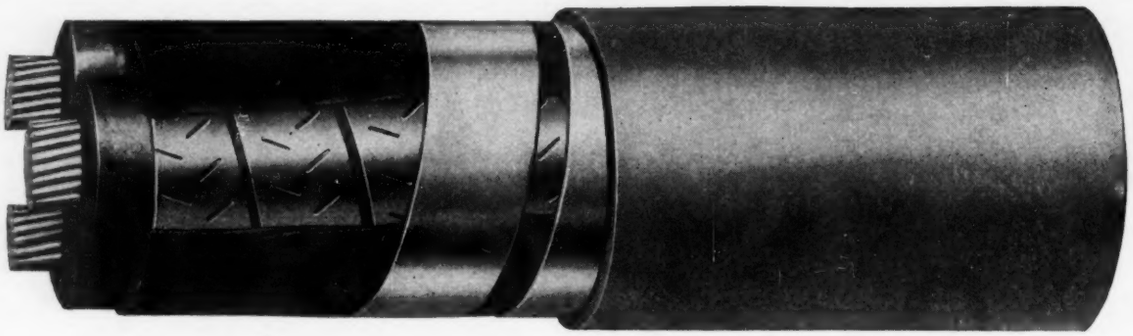

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Electrical World

A McGraw-Hill Publication—Established 1874

L. W. W. MORROW, *Editor*

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In Smith's Steps

THE administration of Governor Roosevelt of New York State has been disappointing. His previous career had been distinguished and his administration was looked upon as promising a step forward in the affairs of the Empire State. But the lure of the Democratic nomination for the Presidency has led him into political byways and away from the constructive policies that he was thought capable of developing. He has stooped to politics.

Artificial issues can be invented for political purposes, and the latest move of Governor Roosevelt is an investigation of the Niagara-Hudson Power Corporation merger. He has, with much sounding of trumpets, set his agents on those who are doing constructive work. Yet he knows that there is no law in New York State providing for the control of holding companies, but that the actual operating properties concerned in the merger are under strict state regulation. He also knows that they have reduced rates consistently and have been alert to every opportunity to extend their service. He knows that any of the executives connected with the properties can give very good reasons for the development of a single corporate entity on a partnership basis and would gladly supply him with any information he desires. But no, he must have an investigation and must give great publicity to the fact that he is having an investigation made. This is good politics in his opinion, but in that of others it will be called cheap politics.

* * * *

European Business Men and Public Ownership

THIS WEEK the fifth biennial congress of the International Chamber of Commerce, in session at Amsterdam, Holland, had up for discussion the comparative results of public and of private ownership of commercial enterprises. Naturally, in an organization of this kind, public ownership fared badly, there being none so poor to do it reverence. With forty-six nations represented, in many of which public ownership of public utilities prevails, the example of the United States, where private ownership predominates, was set up as worthy of emulation. Such a tribute, coming from men who have sounded the depths and shoals of public ownership in Europe and found it wanting, is indeed flattering. But your neighbor's grass always looks greener, and to claim that the prosperity of the United States is attributable to the absence of public ownership is claiming more than Americans will admit.

There are a thousand and one reasons for our prosperity, and they center in that state of mind which is set against waste and inefficiency and is dynamically alert to opportunity. The American business man is opposed to public ownership chiefly and solely because he is a business man and because he has observed that as a rule even poorly managed private enterprises are better run than public concerns. Europeans are also discovering that, however idealistic may be the concept of their publicly operated services, politicians are of the earth earthy. Many nations are therefore, like Italy, reverting to private ownership of utilities or, like Germany, approaching that goal gradually by turning over the operation and management of their utilities to private corporations all the stock of which is owned by the government. Socialism has not found much fertile soil in the United States in which to propagate, and it is encouraging to note the growing enthusiasm and strong conviction of men of affairs in Europe against public ownership after years of experience with it there.

* * * *

A Memorable Centennial to Come

ANOTHER electrical anniversary deserving of widespread celebration is only two years away. This coming event, to which Dr. Elihu Thomson fittingly called attention at the recent Swampscott convention of the American Institute of Electrical Engineers, is the centennial of Michael Faraday's discovery of the relationship between electricity and magnetism. On this fundamental discovery are based today's highly developed systems of generation, transmission, distribution and motor application. Generators, transformers, compensators, controllers, starters, regulators, solenoids, protective devices—all are dependent on the scientific law that Faraday established—the principle of the dynamo-electric machine. Simple in its origin, springing from easy experiments with copper bars or disks, magnets and coils of wire, it was stupendous in its potentialities.

Before Faraday, electricity was a natural phenomenon, a scientific plaything, a peg for learned theory. Franklin, Volta, Ampère, Oersted and other illustrious pioneers could get it no further. Faraday took their work, developed it, added to it and founded the electrical art, of which he is as much the father as Edison is the father of the electrical industry. He had distinguished compeers—Joseph Henry foremost among them—but his was the dominating figure, and the London bookbinder's apprentice wrote his name high on the roll of immortal scientists.

By all means, Faraday's epoch-making achievements, of which that referred to was the greatest but far from the only one, should be celebrated two years from now in a manner that will impress them upon the memory of laymen as well as technicians in all parts of the earth.

There is no proper place in science, discovery and invention for international jealousies. Any rivalry in accomplishment, whether in evidence today or the academical subject of writers and speakers who deduce their facts—not always identical—from historic records, must be made a rivalry of friendship, a competition in well doing. None will acclaim the deeds of Faraday with sincerer enthusiasm than the New World engineers who claim Franklin, Henry and Edison as their countrymen.

* * * *

Smoke and Ash Elimination Problems Are Not Insurmountable

FUNDAMENTALLY, there is but one reason why both smoke and air-borne ash remain as problems for users of fuels and as affronts to communities. It is that engineers and executives have not decided definitely that they will eliminate these nuisances. Any variety of reasons may be conjured up for failure to make this decision, varying from structural limitations of existing plants, shortcomings of such systems as have been developed for disposal and impaired performance of combustion equipment when preventives are used to the old standby of unwarranted expense.

It would be, as any one who has had experience with smoke- or ash-eliminating equipment could tell, more than futile to presume that even the best of present devices are wholly satisfactory. It would be absurd to state that, at the present time, it costs no more to "make a stab" at returning clear gases to the atmosphere than to shrug the shoulders and let it go as it may. It is true that such devices reduce overload capacities of furnaces. But when the management of a coal-burning or an oil-burning plant, whether it be a power station, a factory, a mill, a municipal pumping station or a domestic heater, decides to do the necessary thing, then will the clouds of gloom and the gently falling deposits of powder become lessened as these owners and managers assume the privileges of good citizenship, lend the impetus which will allow the engineer to produce the needed equipment and force the enterprise to bear the burden as a necessary and unavoidable obligation which may not be sidestepped.

* * * *

Are Motors Improving or Deteriorating?

SIGHING for the good old days is the privilege of any one who may be retrospectively inclined toward those pastures which are ever the furthest away, but it was a little surprising, in consideration of the generally conceded advances in the performance and technical features of electrical equipment, to hear a singularly determined defense of modern motors at a recent meeting of electrical engineers. Users of equipment which must meet severe service conditions, where reliability is at a high premium, are justifiably captious about ratings and performance. That some iron and steel engineers apparently feel that the motors of today are less meritorious than those supplied ten, fifteen and thirty years ago may readily be due to the method of rating them. When overloads of generous proportions may be thrown on equipment of one normal rating and similar excess duty cannot be placed on other motors, of more recent manufacture but similarly rated, it is certainly no indication that the latter, as motors, are less sturdy or less deserving of confidence than the older ones. Formerly, owing to a certain lack of fundamental knowledge of material and parts, more generous allowances in factors of safety were allowed, name-plate ratings were conservative, and bulk weight and size took the place of some little designing skill.

Any quarrel with the performance of today's motors, assuming the selection of equipment to have been a judicious one, is based on the error of the early days when one called a 100-hp. motor a 75-hp. motor, and not to any failure to build an honest and dependable 75-hp. device today. If less satisfactory results are obtained, it is not so much the fault of today as of yesterday. Certainly, so far as definitions are concerned, there can be little debate at this date as to what constitutes 75 hp. It is not that motors do less than is promised for them, but that formerly they did a great deal more. Competition, careful buying and progress in the art have made greater accuracy in rating necessary, to the confusion and some little consternation of the oldtimers.

* * * *

Power Cables on Poles

AMERICA is slowly developing an air consciousness in other directions than aviation. A major installation of aërial cable in Detroit affords the background of this observation. Cables strung on poles are no new sight along the roadside—telephone cables thus installed are familiar to everybody. But power cables up in the air are not so common, although a number of companies have made more or less important installations of this kind. The Public Service Company of New Jersey, for instance, has a number of quite extensive runs of aërial cable, having started this practice about eleven years ago. However, aërial cable cannot be said to be widely used, and there is a reasonableness about it which prompts one to inquire why.

Of course, it cannot be said that overhead cable can compare in cost with standard overhead construction, and no one visualizes the substitution of lead-covered cable for open conductors and porcelain insulators. But it may readily be possible in certain conditions that, when all of the factors of operating economy and reliability are included, the discrepancy in cost between the two methods of transmission may not be so large as would appear at first thought. A factor of importance that might enter into calculation of the relative costs of the two types of construction would be the fact that a single-pole line on a single right-of-way might carry more circuits than could be put upon the poles of the same height in standard overhead construction. Undoubtedly, however, very special conditions must exist in order to bring standard urban-type overhead construction at about $4,000 a mile to a higher total figure than cable construction at $10,000 or more a mile.

Probably the chief value of an aërial cable line lies, as in the case of the Detroit installation described in this issue of the ELECTRICAL WORLD, in its utilization as an expedient to cover the gap in system expansion when high-tension open overhead construction is incompatible with the urban character of the route traversed and the load is not heavy enough to justify underground conduits.

The daily and seasonal temperature cycles on an overhead cable would have a much greater range than on one underground. From the cool of midnight to the heat of noon and from the cold of a winter's night

to the temperature of a hot summer's day are widely spaced extremes in terms of cable performance. But the heat absorption by air convection from the cable sheath should at all times be better than the absorption from cable confined underground. This may compensate for the extreme range of temperatures.

As is stated in the article describing the Detroit installation, it is too early as yet for any great sum of operating experience to have been accumulated on this particular installation of aërial cable, although one line has been working satisfactorily for nearly a year. But it is expected that the problems of operation will be no more difficult than with underground cable, and it is possible that they may be more easily disposed of on account of the accessibility of the cable and the comparative ease with which faults may be located. It will be interesting indeed after this cable has been in operation for a term of years to compare its record with that of an equivalent circuit underground.

* * * *

Controlling Exported Energy

NEW HAMPSHIRE'S recent commission finding in favor of the exportation of hydro-electric energy from the Fifteen-Mile Falls development of the New England Power Association into Massachusetts is refreshing in its straightforwardness. The board refuses to allow politics to bedevil the situation, and while working with scrupulous regard for the laws affecting power exportation, treats the whole matter from the engineering standpoint.

The power company will develop more energy than the New Hampshire market can at present absorb. An economic warrant for the project, which involves in the vicinity of $40,000,000, including transmission facilities, is recognized to reside in the Boston Edison contract to take 150,000,000 kilowatt-hours per year from the association over a valuable interconnection trunk. The commission reserves the right to determine New Hampshire's own needs at all times prior to export, including possible sale of energy to other companies and the marketing of energy within the Granite State on terms as favorable as those granted outside its borders, having due regard to all facts and conditions which may affect the matter. Contracts for the sale of power by the association's subsidiary outside New Hampshire are to include the commission's controlling order as a regulatory part.

The finding illustrates how simply a matter of no little legal complication may be resolved at times upon a practical working basis. The intricacies of interstate commerce from the legal standpoint are elaborate in the extreme, and their mastery is just about a full-time task for professional counsel. In the New Hampshire situation the commission properly confines itself to intrastate power requirements and prices, and Massachusetts has similar machinery if future conditions require its use. Should matters arise later involving the joint interests of these states, the two commissions sitting together should be able to settle them without the need of reference to federal authority. On questions of constitutionality the courts are always available up to the highest tribunal. Here would seem to be an admirable instance of the capacity of state regulation to meet a situation which on first thought might appear to be a logical field for federal regulation, but which on mature consideration discloses no such necessity.

"Located by Field"— "Details by Field"

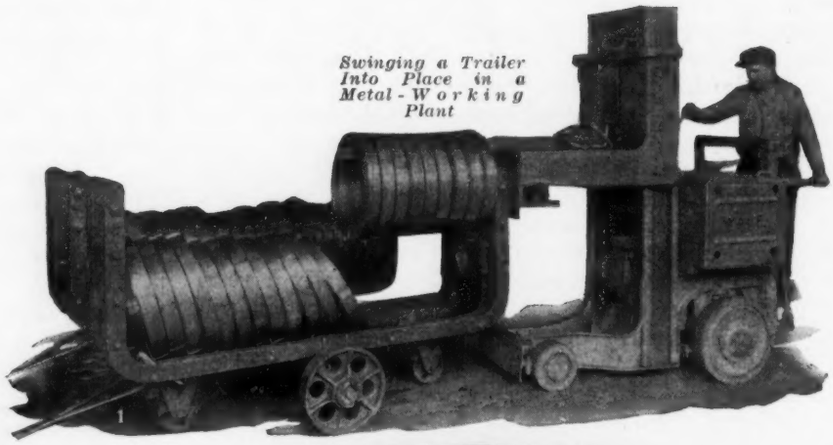
DESIGN drawings for the older and smaller types of power houses were spotted with such notes as "Exact location determined by field," Pipe size determined by field," "Detailed by field," and so on. Such notes have almost disappeared of recent date, and since some of the older engineers and executives find it difficult to understand why it should be more important today to design in detail than was formerly the case, it may not be amiss to bring out the two main reasons which have made this necessary.

The first is the fact that power houses are much more complex than they were in the past. What was justly considered a matter of minor detail on a 1,000-kw. plant often becomes a matter of prime importance on a 100,000-kw. plant. While it may not be necessary to show in detail how the cable should be connected to a 500-kw. machine, it becomes a matter of some importance and requires careful study and scheming in the case of a 50,000-kw. unit, and it might become a serious matter if the details of generator terminal connections did not receive sufficient consideration in the air-duct design. Such details, which many an engineer may desire to dispose of by a wave of the hand, abound in large power houses and often represent the features which establish a design as good or bad. They cannot be left to chance; they must be considered in detail as a part of the whole power-house scheme.

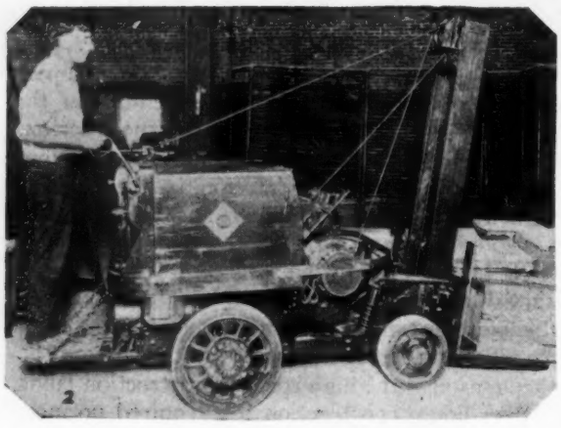
The other reason is the high cost of construction labor. When a power-house construction job required no more than half a dozen electricians at low pay, with one foreman who handled every detail of the work, being himself the principal wireman, the foreman could be depended upon to watch the other trades and see to it that space was provided for his end of the work, that holes were left for his pipes or tubes and that concrete was not poured before his conduits were installed, and there was no cause for delaying construction or for omitting anything. Even if some little parts were overlooked, it was not very difficult to chip out a little concrete and install them, nobody being the wiser.

But with a hundred or several hundred highly paid journeymen electricians working on a large power-house installation, divided into many groups working in different parts of the building, on different floors, the various foremen hardly knowing each other, any detail designing which is left to the field cannot be taken care of by the foremen as a matter of course. It must be taken care of by the field engineering force, and an hour saved in the office drafting room may mean a day spent in the field drafting room. Because construction forces have to work rapidly nowadays, they have no time for scheming. When a detail is not taken care of in time, the corresponding material will not be ordered in time, and a small detail may cause important delays. It may hold up the pouring of concrete for a foundation or a floor or the installation of an important piece of equipment. Detail designing at the principal designing office, where there is co-operation between the various engineers, where there is a force trained in scheming and visualizing instead of "quick shooting," is essential for a modern power house. On going through a completed generating station it is generally quite easy to detect the places for which the drawing carried the note "Details by field."

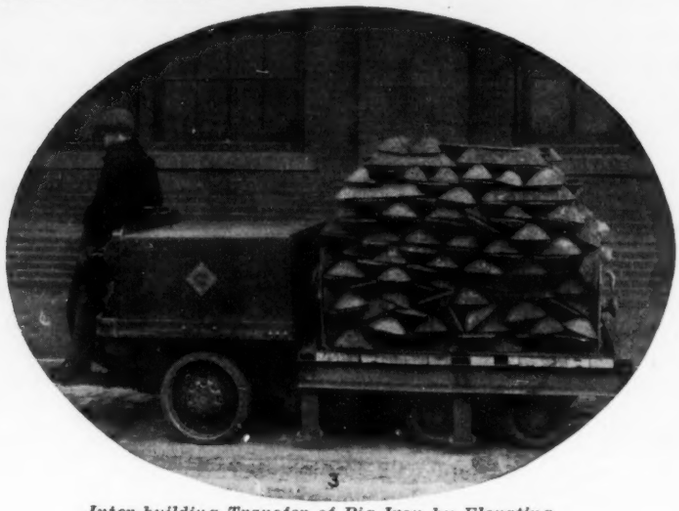
Flexible Service Widens Industrial Truck Market



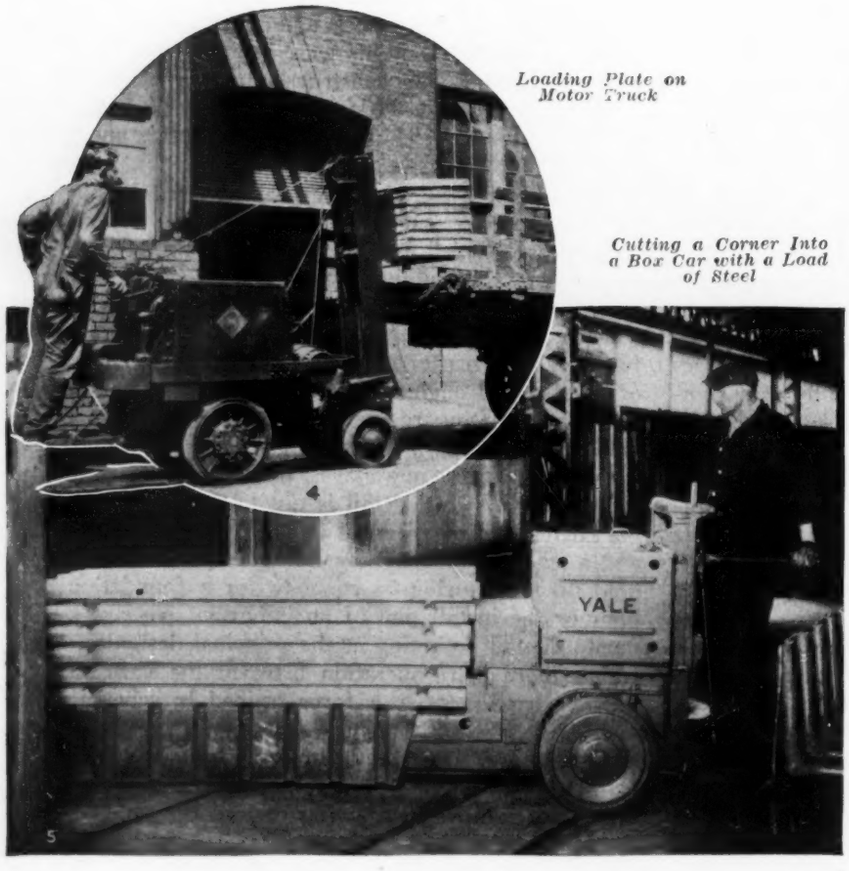
Swinging a Trailer Into Place in a Metal-Working Plant



Unloading Box on Floor Without Blocks



Inter-building Transfer of Pig Iron by Elevating Platform Truck and Unit Container



Loading Plate on Motor Truck

Cutting a Corner Into a Box Car with a Load of Steel

INTERNAL mass transportation in modern factory plants and yards demands an immense variety of handling and conveying machinery. The industrial electric truck has attained a front-line position in this field on account of the adaptability of designing engineers and progressiveness of manufacturer-buyers. From "straight-line" haulage equipment with very limited radii of action, these trucks have been developed to yield maximum service in three dimensions in intensive use on a unit cost-cutting basis. Former limitations of action are disappearing before the advance of the truck designer, and the resulting standardization of multiple types of trucks for diversified service is a prime factor in the development of the market for these unobtrusive but powerful tools of industry.

Unit Costs of Operation

Operating expenses are studied according to broad divisions used by the standard system of accounts

By Robert Teviot Livingston

Assistant Professor of Mechanical Engineering Columbia University

IN SEEKING a check upon the efficiency of operation of any company it is advisable to compare the costs of operation with those of similarly situated companies. Knowing the costs of operation and the usual practice by specific items, it is easy to determine the value in dollars of any change in the equipment or mode of operation. In the previous articles of this series the principal ratios were presented, including the operating ratio, tax ratio, fixed charges, etc. In the present article an attempt is made to analyze the operating ratio in more detail.

The standard system of accounts uses the following broad divisions: Production, transmission, distribution, utilization, commercial, new-business, general and miscellaneous. Naturally the total of these various divisions of costs gives the total operating cost, and the total of the ratio of each one to the gross revenue gives the operating ratio. In the present study the ratio was obtained by dividing the cost by total electric operating revenue, so that regardless of whether the company was an electric company or a combination electric and gas company, the figures thus obtained were directly comparable. The costs are set down in the accompanying table, the first column showing the number of companies studied and the second column the preferred position, which is the peak or median of the frequency distribution curve. The last column shows the range or spread; that is, values between which more than two-thirds of the cases fall.

		Number of Companies	Preferred Position, Per Cent	Range or Spread, Per Cent	
Production	Hydro	43	13.0	.....	Wide spread
	Steam	32	26.0	.....	Very indefinite
	Purchasing	50	....	20.0—36.0	No preferred point
Transmission		97	0.9	0.4— 1.6	All equal in range
Distribution		124	6.8	4.0— 8.4	Wide spread
Utilization		121	0.9	0.6— 1.8	.....
Commercial		120	3.6	1.6— 5.6	.....
New-business		109	0.8	0.3— 1.3	.....
Commercial + new-business		133	4.2	3.4— 6.4	.....
General and miscellaneous, including retirement		146	15.0	11.0—20.0	Enormous range
Retirement	All companies	132	5.5	2.5—11.0	.....
	Hydro	39	10.0	.....	Quite definite
	Steam	26	7.0	.....	Indefinite
	Purchasing	61	5.5	4.5— 6.5	.....
General and miscellaneous alone		144	10.0	0—22.0	Inconclusive

The transmission ratio for Eastern companies, as is shown, is usually a very small item, but it shows a very wide spread and may be anywhere within the limits set. It depends very naturally on the number of miles of line and the voltage of the lines and their location

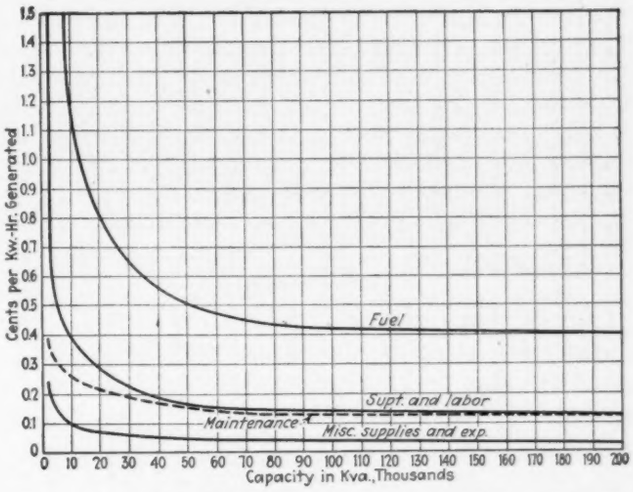


Fig. 1—Unit Operating Costs of New York State Utilities, Steam Plants, 1926

in respect to the roads, as well as a large number of other physical features. The costs of operating and maintaining any specific property cannot be checked by this ratio.

The distribution ratio again is one which varies widely with the physical conditions. The operating and maintenance costs of overhead and underground distribution are materially different and the number of customers per mile of distribution line will affect this ratio a great deal by increasing the revenue per mile of line, while the expenses will not materially change. Another point in the cost of distribution which is not indicated by a ratio and cannot be shown is the depreciation and retirement cost and the energy loss. Both of these are important in determining the true value for the cost of distribution, but neither of them is indicated at all by the ratio. A small loss may be incurred by the installation of large copper, but the capital cost will be great. This is an economic problem of design and does not enter into this study, though its importance cannot be overestimated.

The utilization costs are the costs of operating and maintaining the street lights, and as street lighting contracts usually include the operation and maintenance of the lights by the utility this is a natural operation cost. In itself this ratio means little, as the amount charged to this account depends upon the number and size of the lights, and companies operating in cities will have materially different expenses from those operating in the

country. In order to arrive at a real comparison for this unit the cost should be computed in dollars per year per equivalent 1,000-watt lamp, and this would give a more comparable figure. Such a comparison was not computed for this survey as it was believed that the work was not justified.

The commercial costs are those costs of collecting, meter reading, billing, bookkeeping, etc., and all such costs incidental to the maintenance of local commercial

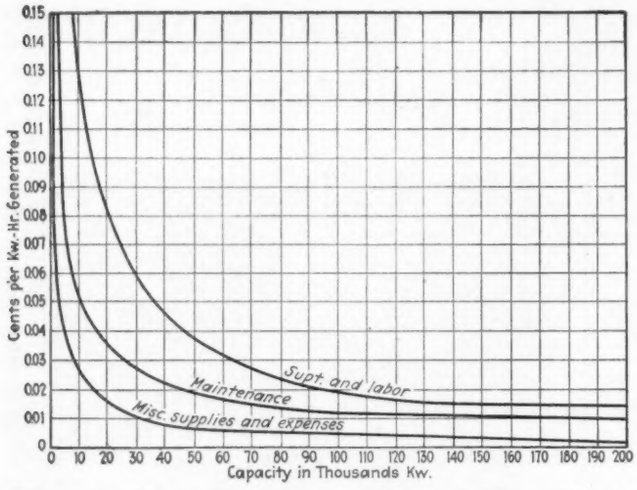


Fig. 2—Unit Operating Costs of New York State Utilities, Hydro-Electric Plants, 1926

offices. The new-business costs are those costs incurred due to the promotion of new and additional customers and business and include demonstrations, commissions, etc. These two costs must really be considered together, as usually not only is the commercial manager the new-business manager but also in all but the largest companies the same clerks, etc., work on both and the separation of accounts is mainly a matter of bookkeeping practice. The policy of the management affects this cost, especially in the new-business department.

The general and miscellaneous expenses are all those expenses of management and operation chargeable to the home office which are not directly charged to some specific phase of operation. Salaries of administrative officers, executives, clerks and stenographers, together with their miscellaneous expenses and supplies, office rent and maintenance and the cost of keeping the corporation books, are here included, as well as certain other items, such as the system stores and transportation facilities and accounts for prepayments. Credits and miscellaneous adjustments of interdepartment charges, etc., are all taken care of. In certain systems of bookkeeping the annual amount charged to retirement is also charged here.

This ratio varies enormously, depending as it does upon the policy of the company. The value is materially different for an independent company from that for an operating unit of a holding company, where many of the natural general and miscellaneous expenses are covered by an engineering and management fee. Another reason for the wide variation on this item is the equally wide variation in the retirement policy of the different companies. The amount to be charged to the retirement reserve is a matter which the company officers decide, their decision being guided by their knowledge of the property and the necessity. A formula often used is that the sum of the retirement and the maintenance equals 12 per cent of the revenue. From this survey it was found that this ratio varies between 8 and 14.5 per cent, being about 12 per cent for hydro companies, 10 per cent for steam companies and 9 per cent for companies which purchase their energy. In the last two cases there are, however, many companies whcih run as high as 14 per cent. It seems probable that retirement ratios should be based on the amount of fixed capital rather than on any arbitrary ratio to the operating revenue. A study on this basis showed that the policy of the various companies varied enormously, though from 1 to $1\frac{1}{2}$ per cent of the sum of the fixed capital and work in progress seemed most usual. Hydro companies varied from 0.5 to 2 per cent, with a definite point at 1 per cent. Steam companies from 0.5 to 1.7 per cent, with an uncertain determination either at 1 per cent or 1.4 per cent. The companies which purchased their energy had the widest spread of 1 to 4 per cent, with a quite definite peak around 1.5 per cent. This higher value seems reasonable when one considers that most of the fixed capital of such a company consists of substation and distribution lines, which must have a higher depreciation rate than generating stations.

These various costs may also be compared on a basis of cents per kilowatt-hour generated or sold, and in most cases a much better determination can be obtained this way.

The production costs may be conveniently subdivided into the following classes:

Superintendence and labor.
Fuel.
Miscellaneous supplies and expense.
Maintenance.

In Fig. 1 are presented two sets of curves of these costs plotted against the system generating capacity, the first of steam plants and the second of hydro plants. The data from which these curves were produced give

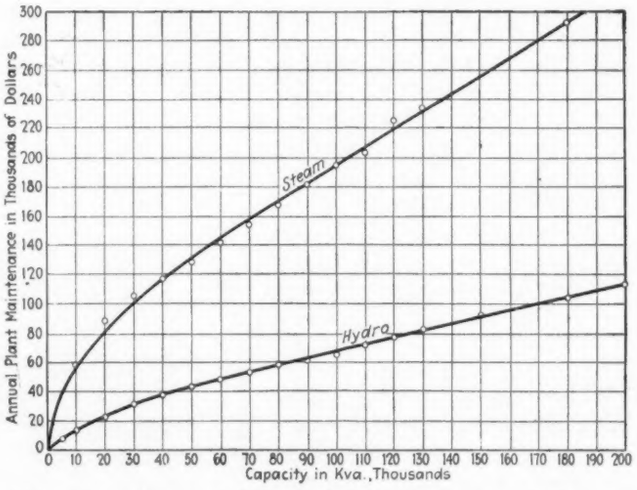


Fig. 3—Annual Plant Maintenance of Steam and Hydro Systems Compared

points which admit of varied interpretation. The curves are intended to be representative; they are envelope curves of all except the extreme cases, which may be considered as "sports" and hence neglected. Actually each of these curves should probably consist of a family of curves for different use factors, but the data presented did not admit of determining this. It appears obvious that for low use factors these values are low and for

high use factors high. Considering the first item, superintendence and labor appears to be practically independent of the amount generated. Any plant which is in regular operation must have a regular crew, and while a plant may be running at only part load the crew is there and will be charged, though it is possible to use some of them on maintenance work. In extreme cases, where the plant is only a peak load plant and the boilers are banked, it is possible to save the cost of one gang and the unit cost may be reduced. In view of the above Fig. 2 has been plotted from other data giving the unit

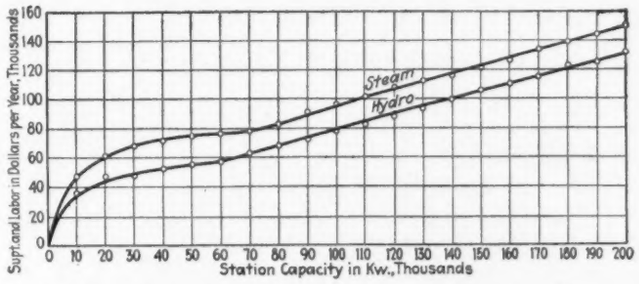


Fig. 4—Superintendence and Labor in Steam and Hydro Plants

cost versus capacity. It was believed and subsequently proved that, regardless of the amount turned out by any station, the superintendence and labor remained the same, or that the superintendence and labor are a function of the capacity. It was found that the unit in dollars per kilowatt capacity per year decreased with the size, and so plotting the actual figures the curve presented was obtained. The same is also true in regard to maintenance.

The curve for fuel is here presented, though this in itself is necessarily less definitely determined than the other. The grade of fuel, the cost of the fuel and the amount of fuel per kilowatt-hour all vary. Actually, rather meager data indicate that for all plants the cost in cents per million B.t.u.'s in the fuel would be a better measure than this one given, but the data are insufficient to give any definite figures.

Transmission and Distribution

The transmission and distribution costs were figured in cents per kilowatt-hour sold and the following results obtained:

	Preferred Position, Cents per Kw.-Hr. Sold	Range	No. of Cases
Transmission (operation)	0.01	—0.13	74
Transmission (maintenance)	0.011	—0.05	75
Total transmission	....	0.005—0.10	96
Distribution (operating)	....	—0.22	95
Distribution (maintenance)	0.08	0.01 —0.28	97
Total distribution	0.16	0.08 —0.44	121
Total transmission and distribution	0.15	0.10 —(0.45) (0.85)	138

These costs are very small and very indefinite and their absolute value is doubtful.

In connection with these costs the system load factor was computed, and while it ranges from 28 to 60 per cent, it seems to be usually about 40 per cent. The use factor naturally is low, being generally about 24 per cent, though with hydro companies it is around 30 per cent. The spreads in the two cases are 16 to 28 per cent and 22 to 44 per cent respectively.

It should be particularly noted that many of these ratios vary widely and are quite indefinite, and hence their value is doubtful and their use limited. In order to try to arrive at more valuable and definite figures the more uncertain but important costs were analyzed from the point of view of costs per customer and will be presented in the next article of this series.

Group Organization for Engineering Department

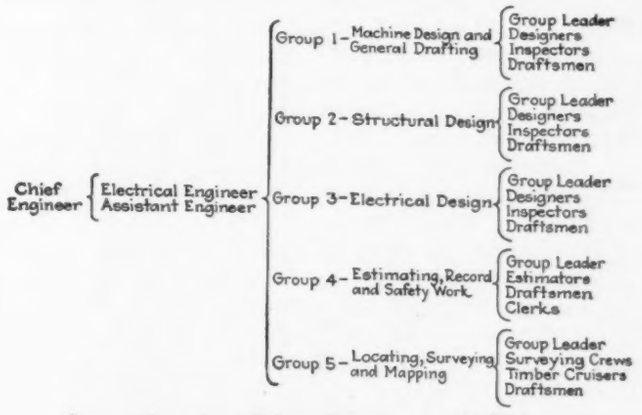
By E. F. Pearson
Electrical Engineer
Northwestern Electric Company, Portland, Ore.

As the engineering force of a utility increases in number with growth of the company, a point is reached sooner or later when it is necessary for the head of the department to delegate definite responsibility to certain men in his department in order that he may have time to devote to the larger and more important problems that arise. Some time ago the Northwestern Electric Company adopted the group system of organization shown in the accompanying diagram for its engineering department. Groups specialize on the work for which the men are best fitted and the system is quite flexible in that men can be shifted from one group to another as the volume and character of work demand.

Designers in their respective groups are used as far as practicable as inspectors on the jobs which they have designed. This continuously increases their knowledge of shop and field practice, gives them a much-needed variation from drafting board work, and having designed the jobs, they are in a better position to catch errors than an outside inspector would be.

The merits of the group system which have been proved to the satisfaction of this company are:

All the minor details of a large number of jobs in process are transferred from the attention of the heads



Organization Plan Increases Efficiency and Lowers Costs

of the engineering department, leaving them adequate time for organization and system planning work. Definite responsibility for the satisfactory completion of each job is placed directly on the group leaders, giving them a greater incentive and developing initiative, which in turn gives them excellent training for greater responsibility. Designers and inspectors individually work on only one job at a time, thereby lessening chances for

error and making possible completion of the job in a minimum of time. A larger number of jobs can be carried on simultaneously with the same number of men, and with each group specializing the work can be handled on a mass production basis more efficiently and at lower cost.

Transformer Capacity Raised by Air Blast Hoods

By G. D. Clark and B. E. Hagy
Westinghouse Electric & Manufacturing Company and Philadelphia Electric Company, Respectively

ONE of the recent advances in transformer practice is the application of the unit type air blast equipment to the self-cooled, oil-insulated radiator type transformer. With this type of equipment a complete blower unit is supplied for each radiator, the unit consisting of a small motor-driven fan mounted in a sheet metal hood, which acts not only as a support and protective housing for the motor but also as a distributor for the air. Air drawn in by the fan is directed against the tubes of the radiator and replaces the column of warm air passing up between the tubes with a supply of cool air, and the heat dissipation from the radiator is greatly increased.

The hood is attached to the radiator tubes by twelve j-bolts, and the fan or the complete assembly may be easily removed for repairs or replacement. The arrangement is thus flexible, as the hoods are designed to operate on the standard tubular type radiator, and as a temporary measure the fans can be installed in a minimum of time to take care of an unexpected overload on a given bank of transformers.

As each fan is supplied with an individual fuse or switch, any outage which may occur will be confined to a single unit and the cooling of the total transformer will not be greatly affected.

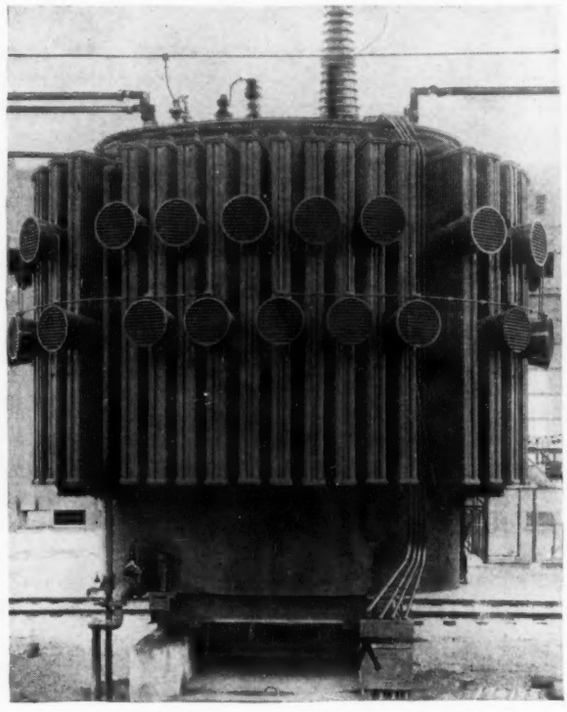
The blower equipment can be arranged for hand starting or for automatic starting. If automatic starting is furnished, a hot oil thermometer is located in the top oil. As the predetermined oil temperature is reached the hot contacts on the thermometer are closed and the fan motors are started up. When the oil temperature falls to a given value the cold contacts on the thermometer are closed and the power circuit to the air blast equipment is opened.

The increase in rating by the use of air blast on the radiators depends largely on the ratio of copper loss to iron loss as this ratio affects the total watts loss for a given increase in load. In general, however, an increase in rating of 30 to 50 per cent can be obtained.

The initial installation of transformers at the Plymouth Meeting substation of the Philadelphia Electric Company, made early in 1928, consisted of seven single-phase, 60-cycle, oil-immersed Westinghouse units with a voltage rating of 220,000 Y/69,000 Y/13,300 delta volts. These seven units form two banks with a spare unit, the 40-deg. C. ambient bank rating being 100,000 kva. for the 220,000- and 69,000-volt windings and 45,000 kva. for the 13,300-volt tertiary winding. In August, 1928, unit type air blast equipment was added to obtain a nominal 40-deg. C. ambient bank rating of 130,000 kva. for the 220,000- and 69,000-volt windings and 58,500 kva. for the 13,300-volt winding.

An alternate method of applying the air blast feature was considered and consisted of a motor-driven blower for each single-phase transformer, the blower being connected to a duct around the base of the transformer from which small air ducts lead to each radiator. In this particular case the investment and power requirements were found to be considerably higher for this alternate method as compared to the hood type. Another factor which led to the installation of the hood type was the greater assurance of reliability obtained, since the failure of a single motor or blower would not materially affect the bank output.

The cost per kilovolt-ampere of the additional transformer capacity obtained by the use of blowers in accordance with the method adopted was only 18 per cent of the cost per kilowatt-ampere of additional transformers. When the installed cost of transformers is considered, including such items as associated oil circuit breakers, disconnecting switches, bus, control, etc., the saving in investment was very much greater. While for this particular installation the addition of blowers to an oil-insulated, self-cooled bank was an attractive proposition, there are, of course, several factors to be considered which necessitate an analysis being made in each case.



Blower Units Increase Transformer Capacity

Automatic Substation Offers Low Cost Reliability

Arrangement of distribution substation to permit use of single high-tension circuit breaker for two supply circuits leads to economical design

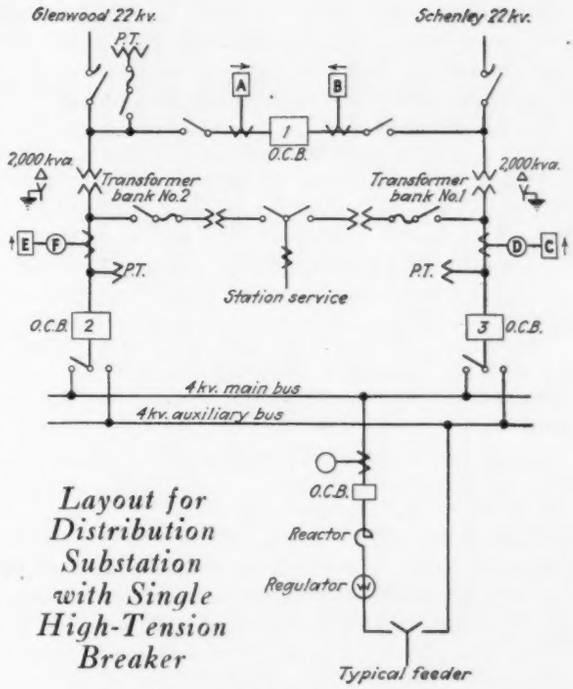
By R. R. Randell

System Development Department, Duquesne Light Company, Pittsburgh, Pa.

AN ECONOMICAL type of unattended substation has been adopted by the Duquesne Light Company for distribution loads up to 12,000 kva., combining reliability of service with low first cost and low maintenance. The station is fed by two high-tension lines, but requires only one high-tension oil circuit breaker. A transformer bank is connected to each high-tension line on either side of a tie breaker and feeds the low-tension bus through a breaker. The banks are normally paralleled on both high- and low-tension sides.

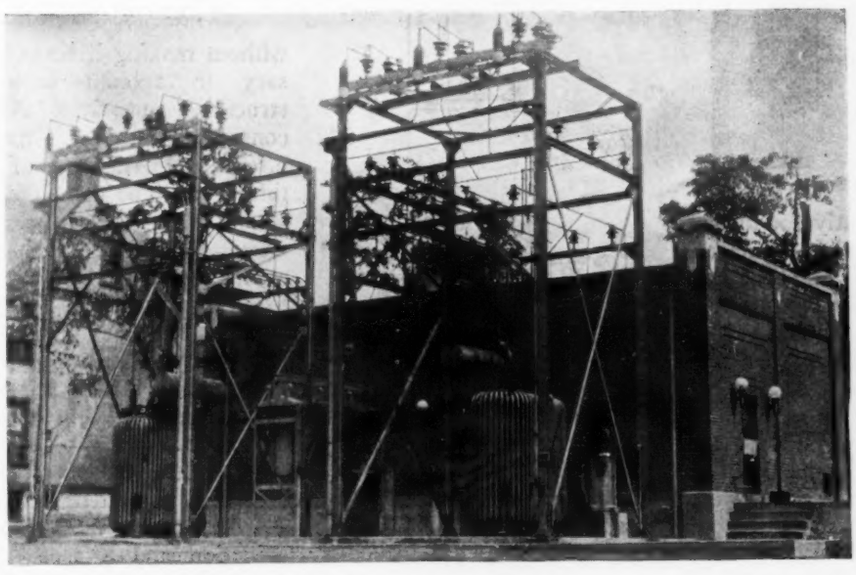
The size of the transformer banks used in this type of station is based upon the assumption that a transformer bank will operate successfully at 150 per cent load for the three- to five-hour duration of the peak load on distribution substations. Each bank has a capacity of 75 per cent of the effective capacity of the station. Thus the total installed transformer capacity is equal to 133 per cent of the effective capacity of the station and each bank is normally 75 per cent loaded. The loss of one bank during the peak-load period will leave the remaining bank 150 per cent loaded. The nominal capacity of the station is, of course, limited by the capacity of one of the incoming transmission lines, since the loss of one line to the station should leave sufficient transmission capacity to carry the station load.

Protection for this type of station presents a problem somewhat different from that of the ordinary loop station. Means must be provided for disconnecting a faulty line from the station and yet leave the station load on the good line. This is done by considering each of the two banks as part of the line to which it is connected. For a fault on one of the high-tension lines, then, the high-tension tie breaker and the low-tension breaker of the transformer connected to the faulty line must be tripped. This leaves the transformer banks separated on both high- and low-tension sides and leaves the good line feeding the station load through the remaining transformer bank. Several schemes of protection for a station of this kind were considered, but the scheme adopted offers the best protection in the most cases of trouble and different running orders.



Layout for Distribution Substation with Single High-Tension Breaker

The relays marked *A* are three 4-12-amp., power-directional relays and one ½-2½-amp. power-directional relay for grounded protection. These relays trip oil circuit breakers No. 1 and No. 3 when power flows through the bus tie breaker in the direction indicated by the arrow beside these relays; that is, when a fault occurs on the side of the station indicated by the arrow beside the relays. The relays marked *B* are similar to relays marked *A*, but have opposite polarity and trip oil circuit breakers No. 1 and No. 2. The relays marked *C* are three 4-12-amp., power-directional relays and trip oil circuit breaker No. 3 when power flows from the low-tension bus into transformer bank No. 1. The relays marked *D* are three 4-12-amp., non-directional, overcurrent relays and trip oil circuit breaker No. 3. The relays marked *E* are three 4-12-amp., power-directional relays and trip oil circuit breaker No. 2 when power flows from the low-tension bus into transformer bank No. 2. The relays marked *F* are three 4-12-amp., non-directional, overcurrent relays and trip oil circuit breaker No. 2.



A Typical Unattended, Single-Breaker Distribution Substation (Hazelwood)

Automatic reclosing equipment is provided for all breakers. The low-tension feeder breakers reclose three times and then lock out. When a fault occurs on a high-tension line the high-tension tie breaker and one of the low-tension transformer breakers are tripped. The high-tension tie breaker then recloses after a suitable interval, and if it remains closed, indicating that the trouble was of a temporary nature and the high-tension line is now good, the low-tension breaker recloses after a delay of fifteen or twenty seconds. This delay is provided so that the low-

tension transformer breaker will not reclose until after the line has been tried by the reclosing of the high-tension tie breaker and found good. In case the trouble is permanent and the high-tension line breaker again trips out it will not reclose.

There are several points which justify the use of this type of unattended station. A high degree of reliability is attained which is comparable to that provided by the ordinary loop station fed by two lines and using two automatic oil circuit breakers. Only one high-tension oil circuit breaker is required, and since the cost of the additional transformer capacity required is less than that of an additional high-tension oil circuit breaker the initial cost is reduced. Annual costs, including fixed charges and losses, but not including maintenance, for this type of station are found to be somewhat less than those for the equivalent ordinary loop station of the unattended variety using two high-tension oil circuit breakers. Maintenance is also slightly less.

The Duquesne Light Company has had ten of these automatic sectionalizing substations in operation over a period of years and is constantly adding to the number on its system, experience having borne out the desirability of this type of station for distribution load from a standpoint of economy, reliability and flexibility of operation.

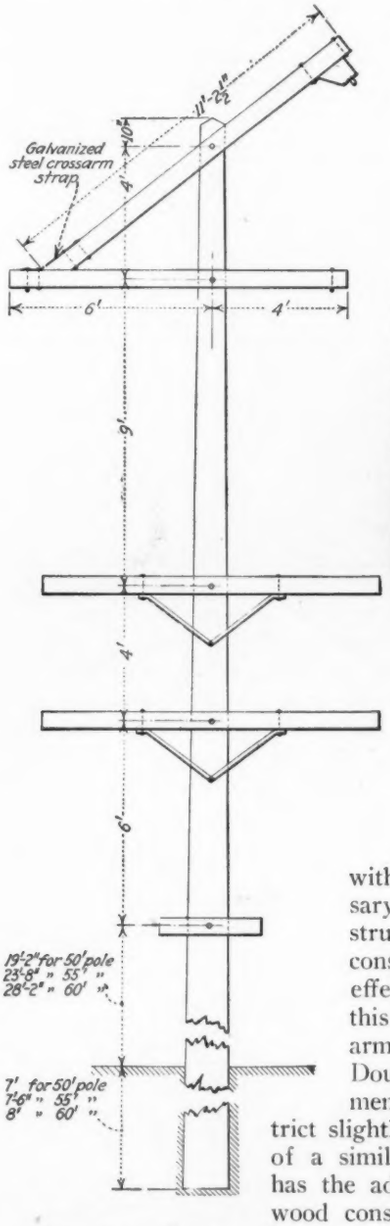
Tree Trimmers' Safety Belt

A SWING board, or saddle, is frequently found to be a cumbersome thing by tree trimmers, particularly if the trimmer must move around from branch to branch. The safety belt which is used by the tree trimmers of the Dayton Power & Light Company, and which was designed by them, is found to be more convenient and is considered safer by O. B. Reemelin, general superintendent of the company. It is an ordinary lineman's safety belt to which have been added a pair of thigh straps and an extra "D" ring at the back. If the trimmer can rest his weight on the branch and needs only protection and some support the holding line can be fastened in the back ring and the man can move about in safety. If no footing is available the trimmer can be carried in the belt by fastening the line or lines to the side "D" rings.

Wood-Arm Wishbone for 66-Kv. Line

By A. C. Wright
Engineer Eastern Oregon Light & Power Company, Baker, Ore.

IN RECONSTRUCTING a 22-kv. pin type wood-pole line to 66-kv., which had a conductor arrangement suitable for 66-kv. pin type insulation but not for suspension type, the Eastern Oregon Light & Power Company used a wood wishbone arm which gave the desired 2 ft. additional clearance for 66-kv. suspension insulators



Unusual Construction Avoided Complete Rebuilding of 22-Kv. Line for 66 Kv.

without making it necessary to rebuild each structure entirely. A considerable saving was effected by the use of this arm. The complete arm, of good, clear, Douglas fir, with attachments, costs in this district slightly less than half that of a similar all-steel arm and has the advantages of the all-wood construction for insulating purposes. It is easily placed since it can be bolted together on the ground and pulled to the top of the pole with hand lines. It is necessary to surface the pole at the lower bolt hole only to get vertical alignment. A standard Hubbard No. 6,725 corner bracket was used for the top conductor insulator connection and a special galvanized $\frac{3}{8}$-in. steel strap with $\frac{5}{8}$-in. galvanized bolts for tying the two arms together. About 14 miles of 66-kv. line of this type is in operation.

Training for Utility Jobs

Employee training school of Insull group of utilities in Chicago molds college graduates to fit central-station requirements. Course serves as experience equivalent and saves time for company and student

By L. L. STARRETT
Commonwealth Edison Company, Chicago, Ill.

THE problem of employee training is an especially important one for public service companies, even when the new employees are college educated. Many companies find that a practical training course adapts the technical knowledge of college graduates to particular company requirements and makes them more valuable employees. Even the specialized utility courses lately added to some college and university curricula do not fit the graduate for immediate assimilation into company organizations. Executives do not expect to find the combined engineering, commercial and administrative requirements of an electric utility fully developed in a student applying for a position. The additional training thus falls at once upon the company, and it can be accomplished effectively by large organizations only through the establishment of departments that will provide the specialized education required.

For the past several years the training school of the Commonwealth Edison Company and affiliated companies, known as the Chicago Central Station Institute, has been gradually adjusted and adapted to this function. The institute was organized as a separate corporation in 1912 and is now sponsored by the Commonwealth Edison Company, the Public Service Company of Northern Illinois, the Middle West Utilities and the Federal Electric Company.

The expenses of the institute are paid by the above-named companies according to the number of employees participating, and if at any time any deficit should be incurred this is made up on a pro rata basis.

The institute has trained 473 men since 1914, the greater number being between 1922 and 1928. During the period 1914-1921 a total of 87 men were trained, while the balance of 386 were given instructions in the institute courses between the years 1922 and 1928.

The process of selecting college graduates for practical training is a limiting factor in the success of the program. If the selection is poor the entire system of training is useless. The problem is not to get as many college men as possible to enter the organization, but to select only those graduates who will best fit in with the work which the various companies will have to offer them after completion of the training. The selection is made by the staff of the institute, because, although the companies might be better qualified to pick men to fit their particular needs, it is felt that a centralized agency of selection and training soon becomes a specialist in such work, and the advantages gained by centralizing the selection more than offsets any possible disadvantages.

A policy of selecting a few undergraduates for summer work each year gives a student an opportunity to determine whether he cares for utility work and just what phase of it he likes best. If he does not like it little time or money has been lost by his employer and both parties are benefited. If he does enjoy the work he has an early start and is a more valuable man to the company at the time of graduation. Then, too, by deciding early what he wishes to do he avails himself of an opportunity, in his last year or two in college, to study courses which will be of value to him in the utility business and this makes possible more rapid progress.

On or about January 1 of each year a study is made of the number of college men that will be required by each of the companies for the succeeding year. This number is usually determined after examining the number of men placed in each company in the past several years and by any special requirements which the industrial relations departments of the several companies may foresee. Usually this number is set conservatively below the normal requirements, so that for

Basis for Rating Applicants

Appearance

Physique	Neatness	Bearing
Dress	Voice	Energy

Intelligence

Ability to grasp a point quickly.
Alertness. Ability to express self.

Leadership Qualities

Force	Decisiveness	Confidence in self
Tact	Initiative	Ability to inspire others
	Experience in leadership	

Personal Characteristics

Friendliness	Loyalty	Sociability
Industry	Absence of conceit or selfishness	
Dependability	Ability to co-operate	

Value to Company

Interest in Insull companies
Special talent (Comm., oper., engr.)
Previous experience or training
Ease of placement
Possibility of development.

Analysis of Central-Station Institute Graduates from 1914 to July 1, 1928

Year of Completion	Number Completed Course	Placed with Commonwealth Edison Company	Placed with Public Service Company	Placed with Middle West Company	Placed with Federal	Placed with State Line	Total Placed	Not Placed: Foreign Students	Illness in Family	Wanted Change in Location	Hard Times—No Jobs	Jobs Offered, Not Accepted	Not Acceptable	Total	Still with Commonwealth Edison Company	Still with Public Service Company	Still with Middle West Company	Still with Federal	Still with State Line	Total in Install Companies	Per Cent Still Employed	Left After Placement: War Period	Decreased	Let Out—Hard Times	Other Position	Reason Not Given	Transferred from One Company to Another	Discharged (Incompetence)	Leave of Absence or Illness	Foreign Student Placed Temporarily	Dissatisfaction with Progress	Change in Location	Returned to College	To go Into Business	Total Left
1914	35	12	6	6	1	..	25	..	..	..	5	5	..	10	1	..	..	..	..	1	4.	16	2	5	..	..	..	..	..	..	..	..	..	..	23
1915	17	8	2	1	1	..	12	..	..	..	5	..	..	5	1	..	..	..	..	1	8.5	11	..	..	..	..	..	..	..	..	..	..	..	1	12
1916	24	16	2	3	1	..	22	..	..	..	2	..	..	2	2	..	..	..	..	2	9.1	10	2	..	..	7	..	..	..	..	..	..	1	20
1917	9	7	1	..	1	..	9	..	..	..	..	..	..	..	2	..	..	..	..	2	22.	4	..	..	..	3	..	..	..	..	..	..	..	..	7
1918	1	1	..	..	..	..	1	..	..	..	..	..	..	..	1	..	..	..	..	1	100.	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1919	2	2	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	0.	..	..	..	..	2	..	..	..	..	..	..	..	..	2
1920	9	7	2	..	..	..	9	..	..	..	..	..	..	..	5	2	..	..	..	7	78.	..	..	..	..	2	..	..	..	..	..	..	..	..	2
1921	7	7	..	..	..	..	7	..	..	..	..	..	..	..	1	..	..	..	..	1	14.2	..	..	..	1	4	1	1	..	..	..	..	..	..	6
Total..	104	60	13	10	4	..	87	..	..	..	12	5	..	17	13	2	..	..	..	15	17.2	41	4	5	1	18	1	..	..	..	..	..	..	2	72
1922	19	18	1	..	..	..	19	..	..	..	..	..	..	..	12	1	..	..	..	13	69.5	..	1	..	1	4	..	..	..	..	..	..	..	..	6
1923	25	15	9	1	..	..	25	..	..	..	..	..	..	..	8	5	1	..	..	14	56.	..	..	..	..	9	1	..	..	..	1	..	..	..	11
1924	51	26	21	1	1	..	49	..	..	2	..	..	2	2	19	19	1	..	..	39	79.6	..	..	..	1	6	..	1	..	1	1	..	..	..	10
1925	79	35	38	5	..	..	78	..	..	..	1	..	1	2	24	29	5	..	..	58	74.4	..	1	..	3	9	..	2	2	..	1	..	..	2	20
1926	87	43	36	7	..	..	86	..	..	..	..	1	1	2	41	27	6	..	..	74	86.	..	..	1	..	..	3	2	1	..	1	3	1	..	12
1927	95	45	36	4	..	3	88	3	1	2	..	1	..	7	39	34	4	..	3	80	88.7	..	..	..	1	1	..	1	1	..	..	1	..	3	8
1928	42	19	20	2	..	..	41	..	..	..	..	1	..	1	19	20	2	..	..	41	100.	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total..	398	201	161	20	1	3	386	3	1	4	..	3	1	12	162	125	19	..	3	319	82.8	..	2	1	6	29	4	6	4	1	4	4	1	5	67
Grand tot.	502	261	174	30	5	3	473	3	1	4	12	8	1	29	175	137	19	..	..	3	70.7	41	6	6	7	47	5	6	4	1	4	4	1	7	139

the past few years there has not been much difficulty in finding positions for the men who complete the training course.

The next step in the process of selection is to get in touch with the faculties of many of the state universities and colleges in the United States. A booklet describing the opportunities offered is usually sent, and also one application form, with the general statement that inquiries are invited from any one interested. Beginning about February 1 the colleges in the states comprising the Great Lakes Division of the National Electric Light Association are visited and applications are left for from ten to twenty students with whom the interviewer was favorably impressed.

A personal rating system based on a comparison with other men of similar age, experience and education is now being used and has been found to be the most reliable of any yet tested. The judgment of the interviewer is important and much of the success of the rating system is dependent upon him. The present minimum requirements for admission are that a student shall be at least average in scholastic standing, shall be of good moral character and small possess such endowments of leadership and personality as have been found to be preferred by the majority of the departments within the companies. For the past several years more than 500 applications a year have been received. From this number a class of 50 to 100 is selected. Upon reporting, a student is first sent to the employment division for physical examination, upon passing which he fills in the regular employment forms and is sent to the department selected for the first assignment.

Institute Curricula

During the year the students in the institute attend classes one-half day a week during the three summer months and two half days a week during the remainder of the year. A regular program of subject material is arranged in four parts: The first three months are devoted to the organization, financial set-up, policies, and management of the supporting companies; in the second three months the student covers production facilities; in the third period, transmission and distribution, and in the last quarter, commercial applications. During the last quarter, also, all phases of the company activities not covered in the previous three periods are taken up.

Written reports of observations and of work covered are required of students fortnightly. Personal benefit accrues from these summaries in that they train the student to put in writing what has been observed, thus developing one of the prime requisites in writing engineering and executive reports.

The departmental assignments are not nearly so uniform as the lecture curricula. In the Commonwealth Edison Company and in the Public Service Company of Northern Illinois there are more than 40 departments or bureaus to which, at some time or other, students may be assigned. Assignment to particular divisions or departments depends upon the individual student. Each student is analyzed and assignments are arranged in accordance with his particular capabilities and desires, and, as far as possible, also in accordance with the needs of the departments.

The general policy is to give all students, whether engineering or commercial, an assignment in some production department. The engineers have a second assignment in distribution and the commercial men an assignment in construction allied to distribution. In this way all students come in contact with some of the fundamental problems of production and distribution. The remaining two or more assignments are arranged to fit the particular needs of the student.

In the conception of this plan of training it was considered that the student's time for the year would be partly on productive work and partly on work which might be beneficial to him, though of little value to the department. In line with this thought, only one-half of the student's time is charged to the department; the remainder is charged to a general education account. Some departments enter into the training spirit wholeheartedly and have a very comprehensive course of training mapped out, so that a student will learn a maximum

amount in the shortest time. Other departments assign students to different productive positions and pay little or no attention to the training phases. In the latter departments a tendency toward dissatisfaction on the part of the student is sometimes noted. A student usually enjoys being a part of the regular production group, first, to test his own abilities and, second, to avoid the feeling of being one set apart. In general, however, he abhors repetitive productive work if it is continued for any great length of time.

Summary of Results

The first course was established in 1912 as a two-year rotation, completing in 1914. The early record, followed by the war period, did not show the best results. Lack of definite educational standards and the shortage of men during the war account for much of the irregularity noticed when comparing present-day results.

In 1922 the program was re-established on a basis comparable to the present method. The total number completing the course from 1922 to July 15, 1928, was 398 men, of whom 386 were placed. Seven of the twelve who were not placed completed the course during the year 1927. Three of the seven were foreign students under the companies' plan of co-operative foreign training. Of the twelve not placed, only one, who was a commercial graduate, was found not suitable for any of the openings available.

Summarizing the replacements in the various companies from 1922 to 1928:

Two hundred and one were placed in the Commonwealth Edison and 162, or 80.6 per cent, remained. Many employees are sent to other properties after short employment in the Commonwealth Edison Company.

One hundred and sixty-one were placed in the Public Service Company and 135, or 86 per cent, remained.

Twenty men were placed in the Middle West Utilities Company and nineteen, or 95 per cent, remained.

Three men were placed in the State Line Generating Company and three remained.

Of the total of 386 placed during this period 319, or 82.9 per cent, are still employed. After the men are placed in the companies all definite contact between them and the institute is severed and their status becomes the same as that of regular employees.

Actual payroll figures for students and graduates of the Central Station Institute are not available for publication. However, it may be said that a student enters the training school with less salary per month than he would normally receive if he were to enter through the regular employment office. The student's salary is increased after the first six months. At the end of one year he is ready to enter a department for permanent work in competition with other college graduates, who have already been located for one year. This differential of salary is practically overcome, as most institute graduates at the end of their training period receive a relatively higher wage than those having spent a year in one particular department without institute training.

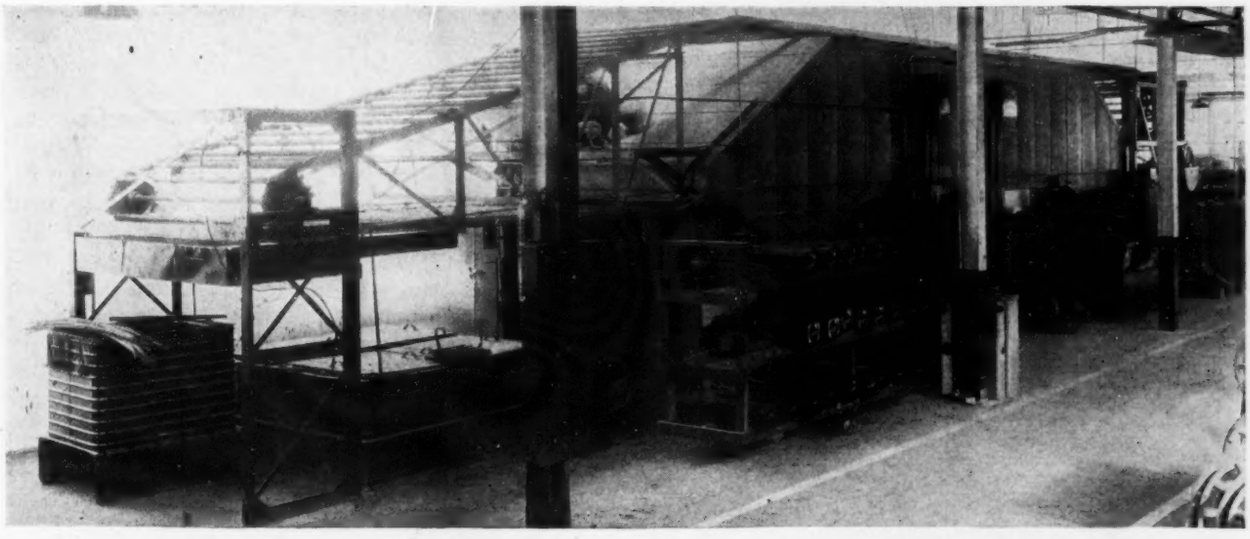
Institute graduates are able to reach, in three and one-half years, including the one year of training, the average wage of all college graduates employed in the same year in the Commonwealth Edison Company. The wage figure of all college graduates includes those who enter the company with years of experience in some other field or utility. They would naturally have a much higher starting wage than the graduate, just out of school.

The results achieved by the institute demonstrate clearly that the training is beneficial both to the utilities who use the men and to the men themselves. The men benefit by receiving what would otherwise come to them only through years of ordinary experience and the companies benefit by getting high-grade employees in a short time.

Electric Enameling Ovens Reduce Fire Hazard and Improve Product

PRINCIPAL among the factors which led the Willys-Overland Pacific Company to install electric enameling ovens in its new Los Angeles assembly plant were reduced fire hazard and assurance of a high quality of product.

The oven illustrated is for small parts, two others not shown being for fenders, using the double-dip process. All are of the conveyor type with recording pyrometers and automatic temperature control. The small oven has a connected load of 66 kw. and operates at 280 deg. F., while the fender ovens have a combined capacity of 150 kw. and operate at 490 deg. F. Service is supplied from 440-volt, three-phase circuits.



One of Three Electric Enameling Ovens in Automobile Assembly Plant

Exterior of Substation Showing Canopies Over Entrance Bushings

Serving a 14,000

Uninterrupted service being paramount to cement mills led to the design and installation of a substation particularly pointed for this goal. Dangers from cement dust and methods of lessening same explained

UTILITIES furnishing electricity to cement plants must provide uninterrupted service and the electrical equipment and layouts in the plant must be so designed, installed and operated as to get continuous production and minimum complication in operation.

An up-to-date substation to supply a cement plant has been built at the Siegfried, Pa., plant of the Lawrence Portland Cement Company. This substation has a transformer capacity of 14,000 kva., which is believed to be greater than that of any other single substation in the cement industry. It is supplied by duplicate 66,000-volt lines of the Pennsylvania Power & Light Company and, as it is located near a large concentration of electric power, main circuit breakers of high-interrupting capacity are employed, in which respect this substation is unsurpassed by any installation in the cement industry.

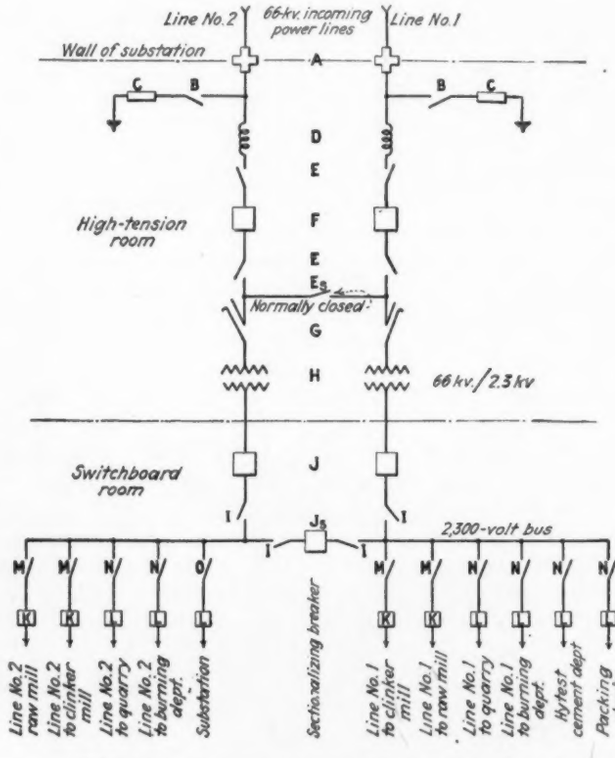
Continuity of power service is particularly important in a cement mill because of the necessity for continuous operation of the kiln, the key item in cement production. The essential feature of portland cement manufacture consists in properly "burning" a suitably proportioned mixture of finely pulverized materials, which in this plant are cement rock and limestone. The clinker produced by the burning operation is then reground into commercial cement.

The burning is done in rotary kilns, huge steel cylindrical shells lined with refractory material, slowly rotated in a slightly inclined position so that the "raw" material gradually works from the upper or feed end toward the lower or firing end, where it is fused at white heat at a temperature of some 2,800 deg. F., produced by a blast of pulverized coal. The cement kiln claims the distinction of being the largest piece of rotating machinery in all industry. The largest of the thirteen kilns at the Lawrence plant is 185 ft. long and weighs 475 tons.

A tremendous amount of heat is stored in a kiln. In shutting down it must be turned slowly for several hours after the firing blast is discontinued, otherwise it will warp due to uneven cooling, causing damaging strains in the shell structure and subsequent uneven operation. If a kiln is shut down for two hours, some five hours' time is required to get it back into normal production, and upon starting up after a long shutdown a full day's run is required to get the equipment into normal balanced operation. It is obvious that to start and stop these units frequently is highly uneconomical.

The kiln is at once the most important single piece of cement mill machinery, the most costly, the most exacting in operating attention and the bottleneck of production. Aside from the particular importance which this unit attaches to power service continuity, there is a whole sequence of machines performing operations preparatory to the burning and another series following the burning. The relationship of other operations to the continuous burning process leads to a schedule, for most of the plant, of twenty-four hours per day seven days per week throughout practically the entire year.

Dust is an ever-present factor in cement mill service, and this is particularly true in a "dry process" plant.



Wiring Connections Showing Dual Feed Connections

Kva. Load

By

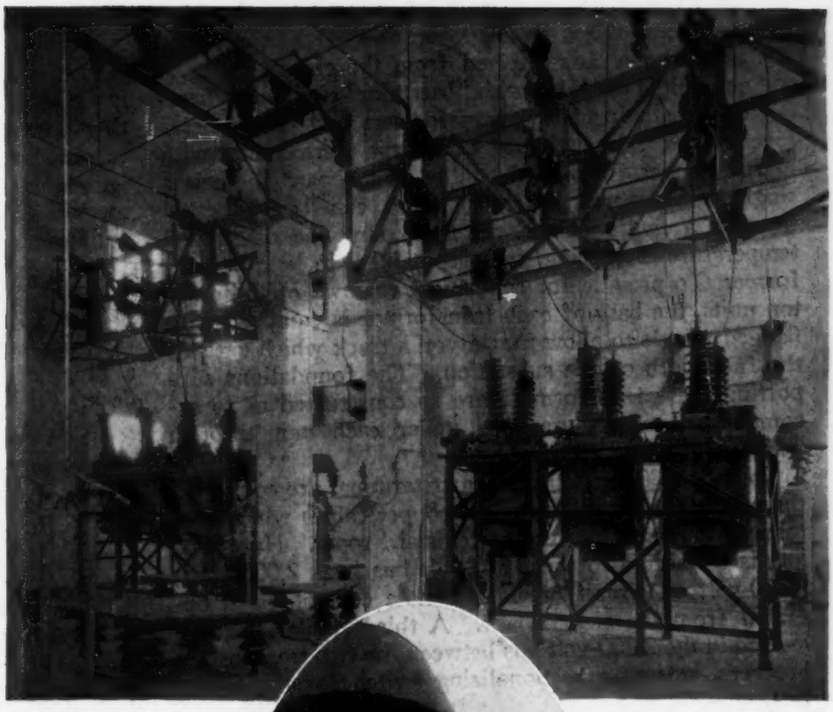
E. G. FLOCK

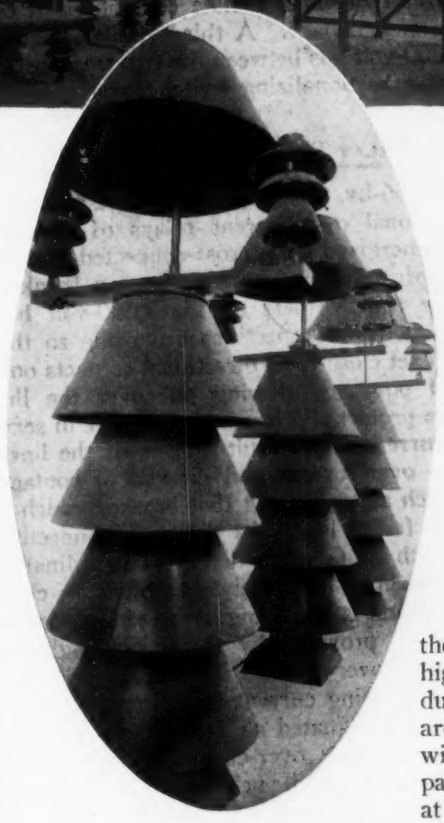
Electrical Superintendent
Lawrence Portland Cement Company

and

M. A. HYDE, JR.

General Engineer Westinghouse
Electric & Manufacturing Company





Main Breakers and Disconnect Switches

Lightning Arresters Placed Indoors Behind Screen

where all grinding is done with the material in dry condition. An observer once remarked that to make cement is to tear down a mountain and put it through a silk handkerchief. That is only half the story, for the finely ground "raw mix" must be burned to clinker, and then the clinker must be ground again so fine as to pass through a sieve the meshes of which will hold water.* Some of this fine dust escapes from the grinding machinery and conveying equipment and from the stacks of the burning kilns and is carried about in the air. Much has been accomplished in abating the dust at this particular plant by installation of dust collectors in various parts of the mill and by the use of an improved conveying system. In fact, for a dry process plant this mill is exceptionally clean. Even so, there is some dust always present, chiefly from the kilns. This dust will settle down upon any exposed surface. A little moisture and some dust soon put a coating on insulators. A coated insulator is a potential source of trouble and under exposed conditions the offending coating must be removed periodically.

To handle the dust problem adequately this complete substation equipment was placed indoors. This feature is substantiated by some ten years' satisfactory experience with another substation on the property which was of indoor construction. While this installation is housed, the building is not dust-tight, although it shields the equipment from direct precipitation of dust and, what is most important, keeps the equipment always dry, so that whatever dust does accumulate can be easily removed. All the high-tension apparatus is of the outdoor type, insulated for 73 kv. except as otherwise mentioned.

ELECTRICAL FEATURES

Two separate incoming 66-kv. lines originate at the power company's Siegfried substation, about a mile away. These are dead-ended on the substation building and connected to 110-kv. entrance buhings. A canopy is provided over each set of bushings to protect them from falling dust and moisture. The equipment in the 66-kv. room is placed in two rows corresponding to the two incoming power lines, with a central aisle between. Liberal floor space has been provided so that the several units are readily accessible.

The main breakers are of particular interest in that they are of unusually high capacity for industrial work. They are 400 amp., 73 kv., with interrupting capacity of 8,800 amp. at 66,000 volts, based on the 2-OCO cycle, which is the equivalent of 1,000,000 arc kva. Since their operation is infrequent, these breakers are manually closed with operating mechanisms located at the breakers. They are full automatic trip from a 12-volt storage battery, through control switches and relays mounted on the switchboard.

DUPLICATE TRANSFORMERS

Transformation to 2,300 volts is accomplished by two three-phase transformers, each of 7,000 kva. capacity, oil-insulated, self-cooled. Each transformer is of capacity sufficient to carry the entire mill load except under heaviest plant operating conditions, when both units are put into service. The mill can thus be operated at good capacity even when one transformer is out of service. The transformers are equipped with four 2½ per cent

**Eighty-three per cent passes through 200 mesh, a screen with 40,000 holes to the square inch.*

undervoltage taps on the high-tension winding and a tap changing switch is provided to permit the changing of these connections from the outside of the case, with the transformer disconnected from the circuit.

Each unit is provided with "Inertaire" equipment, heating coils with insulating transformers and oil temperature indicator, consisting of a dial type thermometer with alarm contact. Mounted on the switchboard there is a single temperature indicator which can be connected through a multi-contact switch to any one of several temperature exploring coils contained in each transformer. To provide for convenient removal of these 34-ton units, the base of each transformer is equipped with flanged wheels to allow moving on a track which extends the full width of the substation. The foundations supporting these transformers are so constructed as to accommodate subway gratings under each unit through which ventilating air rises.

To each 2,300-volt transformer terminal are connected three 800,000-circ.mil stranded copper cables which pass through conduits into the switchboard room. Here each line is connected to the 2,300-volt bus by a 2,000-amp., 7,500-volt oil circuit breaker, remote control, hand operated from the switchboard. A third similar breaker, located in the 2,300-volt bus between the two transformer breakers, acts as a sectionalizing switch for the feeder bus.

Relay Protection

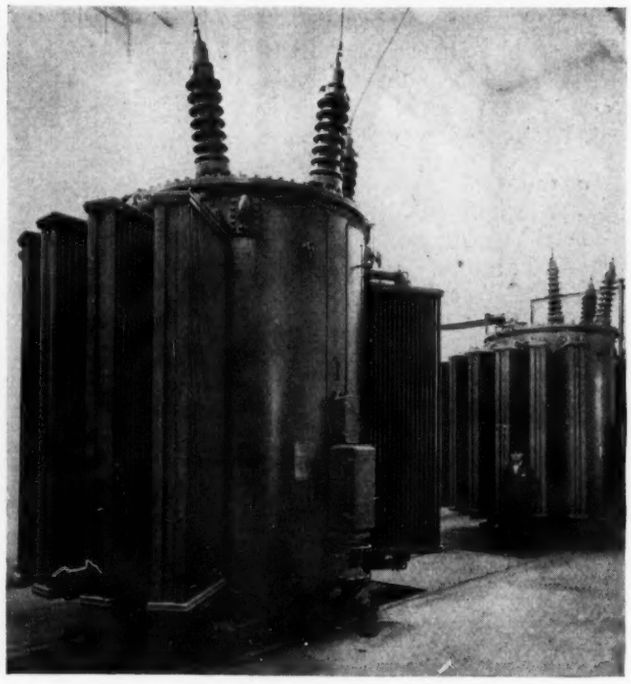
The two parallel 66-kv. transmission lines are protected by six duo-directional over-current relays of the low energy form and energized from cross-connected bushing type current transformers on the high-tension breakers and from voltage transformers on the 2,300-volt bus. The current and voltage connections are made so that the relays of each set close their directional contacts only when unbalanced power is flowing out over the line which these relays protect. When both lines are in service, upon the occurrence of a fault on one of the lines, the action of the over-current and directional contacts in the relays is such as to trip out that breaker which is at the end of the faulty line. As the cross-connecting gang-operated switch E_s (see line diagram) is ordinarily closed, power will then still be received through the clear line. When either line is operating alone straight over-current protection is provided by three Westinghouse type CO low-energy over-current relays and fed from the circuit breaker bushing current transformers.

The two breakers designated as J are each provided with three induction type over-current relays. The breaker J_s is not equipped with such relays, but has current transformer trip, so connected with the auxiliary switches on the breakers J that when these two breakers are in the closed position at the same time the breaker J_s is full automatic and instantaneous in operation on overload, but when either J is open J_s becomes non-automatic in operation. With this arrangement when both transformers are in service and a fault occurs on a 2,300-volt feeder the sectionalizing breaker opens instantaneously, separating the two portions of the bus, and thus decreases the interrupting duty on the feeder breaker (which will open after a certain interval) by limiting the power to that which will be fed through one transformer rather than through the two transformers in parallel. When only one transformer is in operation the sectionalizing breaker, being non-automatic, permits a feeder fault to be cleared on the individual feeder breaker in the usual way.

The relay features localize to a great extent the faults likely to occur on either the high-tension lines or the 2,300-volt feeders, promoting continuity of service in case of trouble on either transmission line and segregating trouble in a particular mill department without shutting down the remaining departments. In cases where repairs have to be made or maintenance work done on individual items of equipment the duplication of apparatus and the flexibility of connections shown in this layout are advantageous.

Distribution Switchboard and Circuits

The 2,300-volt switchboard room, located adjacent to the transformers, contains a seventeen-panel switchboard, a graphic ammeter rack and the substation attendant's desk. Of the switchboard panels, one mounts the power



66/2.3-Kv. Transformers Used to Supply the Plant Load

company's meters, two control the two 66-kv. incoming lines, three control the transformer secondary and sectionalizing breakers and eleven control 2,300-volt feeders to the various parts of the plant. The feeder breakers are all manually operated, with 12-volt direct-current tripping through induction type over-current relays. From these breakers the feeder circuits pass out to the mill via underground lead-covered cables.

Several transformer banks in suitable locations about the plant step the power down to 220 volts for the smaller motors, those 50 hp. and above being generally operated on 2,200 volts. The provision of duplicate circuits for the major departments, quarry, raw grinding, burning and clinker grinding, permits one of these circuits to be isolated in case of trouble or for maintenance work without suspension of operations in the department. A 2,300 to 230-volt transformer bank in the basement of the substation supplies the substation lights, appliance motors and rectigon charger on the breaker trip storage battery.

The use of an integrating watt-hour meter on each feeder circuit as well as on the two incoming circuits from the power transformers enables close check to be

kept not only on the power consumption of the plant as a whole but on the consumption within each mill department, which is quite advantageous in departmental cost accounting. A particularly interesting feature is a bank of graphic ammeters located at one end of the switchboard room. These are connected in the controller circuits of the most important drives throughout the plant and are supplied with seven-day charts. As records of current consumption these charts are of much less importance than as continuous graphic records of the schedule of operation and the exact nature of load variations on their respective machines. With these records there is no question as to when or how long a certain mill is out of service. Improper operation is readily detected, in some cases more easily than could be done at the mill location.

85 per Cent Yearly Load Factor

The switchboard attendant has telephone communication from his desk with all parts of the plant and is at all times in close attention to the behavior of the plant load. He is charged with regulation of the mill operations to secure the highest possible plant load factor. A yearly load factor of 85 per cent has been attained, and under favorable plant operating conditions a daily load factor as high as 75 per cent. In calculating the load factor values, the average kilowatt load is taken on a 24-hour basis, 365 days per year. The kilowatt demand is taken as the average of the four highest fifteen-minute integrated demands occurring during the month, and the highest demand thus determined establishes the billing demand for the succeeding eleven months. With a demand of 6,550 kw. at this plant a reduction of 1 per cent means a saving of about $200 per month in power billing, and as the demand might easily be 10 per cent higher without load supervision, it is evident that this load control effects substantial savings in demand charges. It is interesting to note that through the operation of 24 synchronous motors, 200 hp. and above, throughout the plant, average monthly power factors of 95 per cent are usual and a 24-hour average of 97.2 per cent has been attained.

The basement of the substation building is given over to electrical stores. There are approximately 430 motors installed in this plant, of various ratings up to 450 hp. To simplify the spare equipment problem a relatively small number of different standard ratings was determined upon and the various drives equipped with motors of these ratings as far as possible. This policy was well executed in connection with the central equipment; for instance, all squirrel cage motors 20 hp. and below are controlled by 120 line starters identical in construction except for the elements of the thermal overload relays, which vary for the different ratings. This makes for economy and convenience in providing ample spare parts and spare units. Portions of the substation basement are devoted to motor storage, control storage and a separate room for miscellaneous electrical supplies and small parts.

Perhaps the most interesting feature in this basement is a centrifugal oil purifying outfit, consisting of a centrifuge and a pump located beneath the transformers, and installed with piping so arranged as to permit continuous circulation of the oil from either of the transformer units through the purifier, when it is desired to clean the oil, without disturbing the unit in any way. Each transformer contains 3,000 gal. of oil, purification of which would cost about $300 if done outside. Through troubles on the power company's lines the high-tension breakers have on several occasions been called upon to rupture enormous currents, which duty impairs the switch oil. Each breaker requires 780 gal. of switch oil, worth about $280, and the oil in one of the breakers was reclaimed on three occasions during the last summer by treatment in the purifier. This equipment has also effected considerable savings by treatment of the oil from switches, controllers, motor bearings and even speed reducers throughout the plant. The purifier cost installed, including piping, about $1,400, and will more than pay for itself in the first year's operation.

The following cost data apply to this installation:

Building, bare	$32,850
Equipment, at site	78,050
Installation materials	5,620
Installation labor	5,210
Total initial cost	$121,730

The operating force consists of a day and a night attendant and a day storekeeper in the basement. Although involving a share of the existing supervision cost charged to the electrical department, the construction and operation of the substation have entailed no increase over the normal supervision expense.

In examining the above cost figures, it will be of interest to note that the item "equipment" is made up as follows:

	Per Cent
66-kv. apparatus, exclusive of transformers	33
Transformers and low-voltage apparatus	66
Non-electrical equipment (heating plant, lockers, furniture)	1

The low-voltage apparatus and transformers represent two-thirds of the total equipment. Costs on these items would vary considerably for different sizes of installations. With the high-tension equipment this is not true. Here insulation and mechanical considerations—and, for the circuit breakers, rupturing capacity—are usually the determining factors rather than normal current-carrying ability. Practically the identical high-tension equipment would have been used in this installation that would be needed to carry a plant load of half or of twice this size, which is a demonstration of the fact that for supply voltages of this order, with a given type of layout, the choice of high-tension equipment—which in turn affects the building and installation costs—is determined largely by the characteristics of the power system rather than by the size of the plant load.

The station was built by the Lawrence Portland Cement Company in collaboration with the Pennsylvania Power & Light Company, the concrete construction being by the Burrill Engineering & Construction Company.

Oil Switch Installation Inspection

By W. K. Danvers

Superintendent Maintenance and Reclamation, Oklahoma Gas & Electric Company, Oklahoma City, Okla.

PLACING a large oil circuit breaker in service is a comparatively simple matter. However, a complete inspection should always be made before it is accepted by the operating department. The operating mechanism should be looked over to see that it operates freely and

without binding. The bushings and electrical connections should be inspected and assurance made that the contacts line up properly and have the proper tension when the breaker is closed. If the breaker is electrically operated, check the closing and trip mechanisms and wiring and see that the relays, if there are any, are properly connected. See that the oil is at the proper level when the tanks are in place. The oil should be tested for dielectric strength. The oil in the switch should be again tested within a week after the equipment is in operation in order to detect any moisture that might be present on account of breathing and condensation or by being driven out of the structural material itself through the maintenance of higher temperatures in operation.

The frequency of inspections after the equipment has been placed in operation is open to discussion. It is generally agreed, however, that all oil-filled apparatus, including oil breakers, operating at a pontential of 40 kv. or over, should be inspected at least every six months and it has been recommended that this period be reduced to three months for 66-kv. equipment. This period depends, to a large extent, upon climatic and load conditions and should not be confused with the inspections required on all oil circuit breakers after they have operated a predetermined number of times.

Determining Voltage Drops in Non-Reactive A.C. Feeders*

A new method of solving voltage problems which is especially applicable to close conductor spacing

By Max Kushlan

New England Power Company, Boston, Mass.

IN THE design of feeders it is necessary to provide sufficient conductor capacity to insure a proper working voltage at the terminals of the most remote receiving device under the worst conditions of loading. For alternating-current feeders this involves a study of the estimated maximum current demands in the line, the location of all current-consuming devices, the value of line impedance for a given frequency with various sizes and spacings of conductors and the anticipated power factors of the receiving circuits. For short underground alternating-current feeders the problem may be simplified by assuming the line reactance to be negligible, the potential difference between the feeder terminals being equivalent to the straight resistance drop in the line.

The method of computing voltage drops by the use of the accompanying three tables is close enough for short non-reactive feeders or for feeders having a value of line reactance not exceeding 10 per cent of the line resistance. Under these conditions the results are accurate to the nearest 0.05 of 1 per cent, which compares favorably with the much longer mathematical or graphical solution of such problems.

*Book rights reserved.

Table I—Resistance Drop (in Volts) per Ampere for 1,000 Ft. at 20 Deg. C. (68 Deg. C.)

Size A.W.G.	Area Circ. Mils	*IR* Drop — 97 Per Cent Copper, Solid: Single Wire	Terminal 1-Phase	Terminal 3-Phase	*IR* Drop — 97 Per Cent Copper, Stranded: Single Wire	Terminal 1-Phase	Terminal 3-Phase
19/25	6,150	.....	.....	.....	1.776	3.552	3.076
19/22	13,090	.....	.....	.....	0.86	1.72	1.489
14	4,107	2.608	5.216	4.517	.....	.....	.....
12	6,530	1.640	3.280	2.840	.....	.....	.....
10	10,380	1.032	2.064	1.787	.....	.....	.....
8	16,500	0.649	1.298	1.124	0.662	1.324	1.146
7	20,800	0.515	1.030	0.8919	0.525	1.050	0.9093
6	26,300	0.407	0.814	0.7049	0.416	0.832	0.7205
5	33,100	0.323	0.646	0.5594	0.330	0.660	0.5716
4	41,700	0.257	0.514	0.4451	0.262	0.524	0.4538
3	52,600	0.204	0.408	0.3533	0.208	0.416	0.3603
2	66,400	0.161	0.232	0.2788	0.165	0.330	0.2858
1	83,700	0.128	0.256	0.2217	0.131	0.262	0.2269
0	106,000	0.101	.202	0.1749	0.103	0.206	0.1784
2/0	133,000	0.0805	0.1610	0.1394	0.0821	0.1642	0.1422
3/0	168,000	0.0638	0.1276	0.1105	0.0650	0.1300	0.1126
4/0	212,000	0.0505	0.1010	0.0875	0.0515	0.1030	0.0892
....	250,000	.....	.....	.....	0.0437	0.0874	0.0757
....	300,000	.....	.....	.....	0.0364	0.0728	0.0630
....	350,000	.....	.....	.....	0.0312	0.0624	0.0540
....	400,000	.....	.....	.....	0.0273	0.0546	0.0473
....	450,000	.....	.....	.....	0.0243	0.0486	0.0421
....	500,000	.....	.....	.....	0.0219	0.0438	0.0379
....	750,000	.....	.....	.....	0.0146	0.0292	0.0253
....	1,000,000	.....	.....	.....	0.0109	0.0218	0.0189

The line resistance drop in any given feeder may be computed by multiplying the proper value found in Table I by the product of the line current in amperes and the length of feeder in thousands of feet. For example, to find the resistance drop in a three-phase line having a maximum load of 300 amp., 500 ft. long, using three No. 0000 cloth-insulated stranded copper wires in conduit, we have, from Table I, the drop for 1,000 amp.-ft. is equal to 0.0892 volts.

The voltage drop in this line is equal to:

$$0.0892 \times 300 \times 0.500 = 13.38 \text{ volts.}$$

The line voltage drop may be expressed in terms of percentage referred to the terminal voltage at either end of the feeder by the use of Table II. The values in

Table II—Line Voltage Drop in Per Cent of Terminal Voltage

Drop	Volts at Distributing Point: 115	230	460	575	2,300	13,800	Volts at Load: 110	220	440	550	2,200	13,200
Volts												
0.1	0.09	0.04	0.02	0.02	0.00	0.00	0.09	0.04	0.02	0.02	0.00	0.00
0.2	0.17	0.08	0.04	0.03	0.00	0.00	0.18	0.09	0.04	0.04	0.01	0.00
0.3	0.26	0.13	0.06	0.05	0.01	0.00	0.27	0.14	0.07	0.05	0.01	0.00
0.4	0.35	0.17	0.08	0.07	0.02	0.00	0.36	0.18	0.09	0.07	0.02	0.00
0.5	0.43	0.21	0.10	0.09	0.02	0.00	0.45	0.23	0.11	0.09	0.02	0.00
0.6	0.52	0.26	0.13	0.10	0.03	0.00	0.54	0.27	0.14	0.11	0.03	0.00
0.7	0.61	0.31	0.15	0.12	0.03	0.00	0.64	0.32	0.16	0.13	0.03	0.00
0.8	0.70	0.35	0.17	0.14	0.03	0.01	0.73	0.36	0.18	0.14	0.04	0.01
0.9	0.78	0.39	0.19	0.16	0.04	0.01	0.82	0.41	0.20	0.16	0.04	0.01
1.0	0.87	0.43	0.21	0.17	0.04	0.01	0.91	0.45	0.23	0.18	0.04	0.01
2.0	1.74	0.87	0.43	0.35	0.09	0.01	1.82	0.91	0.45	0.36	0.09	0.01
3.0	2.61	1.30	0.65	0.52	0.13	0.02	2.73	1.36	0.68	0.54	0.14	0.02
4.0	3.48	1.74	0.87	0.70	0.17	0.03	3.64	1.82	0.91	0.73	0.18	0.03
5.0	4.35	2.17	1.08	0.87	0.22	0.04	4.54	2.27	1.14	0.91	0.23	0.04
6.0	5.22	2.61	1.30	1.04	0.26	0.04	5.45	2.73	1.36	1.09	0.27	0.04
7.0	6.09	3.04	1.52	1.22	0.30	0.05	6.36	3.18	1.59	1.27	0.32	0.05
8.0	6.96	3.48	1.74	1.39	0.35	0.06	7.27	3.64	1.82	1.45	0.36	0.06
9.0	7.82	3.91	1.95	1.56	0.39	0.06	8.18	4.09	2.04	1.64	0.41	0.07
10.0	8.69	4.34	2.17	1.74	0.43	0.07	9.09	4.54	2.27	1.82	0.45	0.08
20.0	17.39	8.69	4.34	3.48	0.87	0.14	18.18	9.09	4.54	3.64	0.91	0.15
30.0	26.08	13.04	6.52	5.22	1.30	0.22	27.27	13.63	6.81	5.45	1.36	0.23
40.0	34.78	17.39	8.69	6.96	1.74	0.29	36.36	18.18	9.09	7.27	1.82	0.30
50.0	43.47	21.73	10.86	8.69	2.17	0.36	45.45	22.72	11.36	9.09	2.27	0.38
60.0	52.17	26.08	13.04	10.43	2.61	0.43	54.54	27.27	13.63	10.91	2.73	0.45
70.0	60.86	30.43	15.21	12.17	3.04	0.50	63.64	31.82	15.91	12.73	3.18	0.53
80.0	69.56	34.78	17.39	13.91	3.48	0.58	72.73	36.36	18.18	14.54	3.64	0.61
90.0	78.25	39.12	19.56	15.65	3.91	0.65	81.82	40.91	20.45	16.36	4.09	0.68

Table III—Per Cent Voltage Drop in Non-Reactive A.C. Feeders

Line Voltage Drop (Per Cent)	Load Power Factor (Per Cent)												
	40	45	50	55	60	65	70	75	80	85	90	95	100
1.0	0.40	0.45	0.51	0.55	0.59	0.64	0.69	0.75	0.82	0.86	0.90	0.95	1.00
2.0	0.82	0.92	1.02	1.12	1.22	1.31	1.41	1.50	1.60	1.71	1.83	1.91	2.00
3.0	1.23	1.38	1.53	1.68	1.84	1.99	2.14	2.28	2.43	2.57	2.71	2.85	3.00
4.0	1.67	1.86	2.06	2.25	2.45	2.64	2.84	3.04	3.25	3.43	3.62	3.81	4.00
5.0	2.11	2.35	2.60	2.84	3.09	3.33	3.57	3.80	4.04	4.28	4.53	4.76	5.00
6.0	2.55	2.84	3.14	3.43	3.72	4.00	4.28	4.57	4.87	5.15	5.44	5.72	6.00
7.0	3.00	3.33	3.67	4.02	4.37	4.70	5.03	5.35	5.67	6.01	6.35	6.67	7.00
8.0	3.48	3.85	4.23	4.61	5.00	5.39	5.78	6.15	6.52	6.89	7.27	7.63	8.00
9.0	3.95	4.37	4.80	5.23	5.67	6.08	6.50	6.93	7.36	7.77	8.18	8.59	9.00
10.0	4.43	4.90	5.37	5.84	6.32	6.79	7.27	7.72	8.17	8.63	9.10	9.55	10.00

INTERPOLATION TABLE

(Based on Average Differences)

Line Voltage Drop (Per Cent)	Load Power Factor (Per Cent)												
	40	45	50	55	60	65	70	75	80	85	90	95	100
0.1	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.10
0.2	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.20
0.3	0.13	0.15	0.16	0.17	0.19	0.20	0.22	0.23	0.24	0.26	0.27	0.29	0.30
0.4	0.18	0.20	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.34	0.36	0.38	0.40
0.5	0.22	0.24	0.27	0.29	0.32	0.34	0.36	0.39	0.41	0.43	0.45	0.48	0.50
0.6	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.46	0.49	0.52	0.55	0.57	0.60
0.7	0.31	0.34	0.38	0.41	0.44	0.47	0.51	0.54	0.57	0.60	0.64	0.67	0.70
0.8	0.35	0.39	0.43	0.46	0.51	0.54	0.58	0.62	0.65	0.69	0.73	0.76	0.80
0.9	0.40	0.44	0.48	0.52	0.57	0.61	0.65	0.69	0.73	0.78	0.82	0.86	0.90

this table are based on the voltages most commonly used at the feeder distribution board or at the motor terminals. To illustrate the use of Table II, we will assume the same feeder line with a drop of 13.38 volts, the voltage at the feeder board being 460 volts.

Referring to the table, for 460 volts at the point of distribution, the per cent drop is as follows:

For a drop of 10 volts, the per cent drop is 2.17
For a drop of 3 volts, the per cent drop is 0.65
For a drop of 0.4 volts, the per cent drop is 0.08

Total for 13.4 volts, in a 460-volt circuit, 290 per cent.

The final voltage drop in any alternating-current feeder circuit may be defined as the arithmetical difference between the measured voltage at the point of distribution and the corresponding voltage in the same phase at the receiver. A simple method of computing the values of feeder voltage drops is based on a trigonometric solution of the feeder circuit vector diagram.

The values of voltage drops, expressed in per cent of feeder board voltage, have been computed in Table III, between the values of 0.1 and 10.0 per cent of line drop, for receiver power factors from 40 to 100 per cent. The drops for the integral percentage line drops were calculated by formulas. The values for the decimal percentage line drops in the interpolation table have been computed based on the average differences between the corresponding integral percentages. The error introduced by this interpolation is less than 0.05 of 1 per cent.

Referring to the feeder problem described in connection with Tables I and II, the feeder having a line drop of 2.9 per cent, and assuming a load power factor of 80 per cent, the feeder voltage drop may be determined from Table III, as follows:

At 80 per cent power factor
for a 2 per cent line drop, V.D. = 1.60 per cent
for a 0.9 per cent line drop, V.D. = 0.73 per cent
Total voltage drop ..... = 2.33 per cent

With a terminal voltage at the feeder switchboard of 460 volts, the voltage at the receiver terminals will be:

$$4.60 \times (100 - 2.33) = 24.60 \times 97.67 = 449.28 \text{ volts}$$

This would indicate that the feeder was designed to supply a 440-volt motor load safely for a maximum demand of 300 amp. without interruption of service due to low voltage at the motor terminals.

Dairy Electrification Yields High Return to Farmer

FIGURES which were carefully compiled and checked and rechecked by E. G. Stahl, agricultural power specialist of the San Joaquin Light & Power Corporation, Fresno, Calif., are presented in the accompanying table to show net profit per cow to the power company and dairyman resulting from electrification. On a unit investment of $140 per cow for a 30-cow dairy the net yearly saving or return on the investment is $61.24 to the dairyman and the revenue to the power company is $7.52 per cow at 2 cents per kilowatt-hour.

All of the figures in the table will be of value to dairymen and power company salesmen interested in dairy electrification. So good a case do they make for electrification that salesmen of the San Joaquin system will use them to convince dairymen of its benefits.

Benefits Obtained by Electrification of 30-Cow Dairy

Equipment	Installation Cost Complete	Interest and Depreciation at 20 Per Cent	Annual Kw.-Hr.	Annual Cost	Total Cost, Interest, Depreciation and Power	Saving in Labor and Expense	Increased Value of Milk	Net After Deducting Cost of Operating Equipment
Lights	$150.00	$30.00	360	$7.20	$37.20	$60.00	.....	$22.80
Water for cleaning and drinking	150.00	30.00	648	12.96	42.96	120.00	91.14	168.18
Sterilizer	100.00	20.00	2,160	43.20	63.20	.....	516.46	453.26
Milking machine	450.00	90.00	900	18.00	108.00	600.00	.....	492.00
Refrigerating plant	1,500.00	300.00	6,500	130.00	430.00	.....	607.60	177.60
Feed grinder	350.00	70.00	720	14.40	84.40	300.00	.....	215.60
Total electrical equipment	$2,700.00	$540.00	11,288	$225.76	$765.76	$1,080,00	$1,215.20	$1,529.44
Building improvements	1,500.00	300.00	.....	.....	300.00	.....	607.60	307.60
Total	$4,200.00	$840.00	11,288	$225.76	$1,065.76	$1,080,00	$1,822.80	$1,837.04
Unit per cow	$140.00	$28.00	375	$7.52	$35.52	$36.00	$60.76	$61.24

Electric power figured at 2 cents per kilowatt-hour. This estimate assumes a saving in labor of $780 per year by the use of electricity for lights, pumping water and operating a milking machine. These figures are conservative.

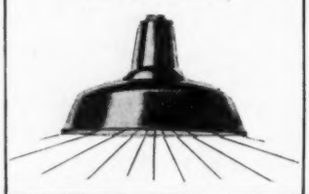
It also assumes a reduction of 10 per cent in the amount of feed that is required on account of grinding. The increase in value of milk is obtained by raising the standing from factory milk at 60 cents per pound butterfat to rade A market milk at 81.7 cents per pound butterfat. There is an increasing demand for grade A market milk. This quality of milk can be produced more economically by the use of electrical dairy equipment.

Lamp Size and Outlet Spacing for Various

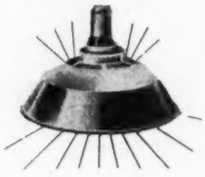
(Franklin Specification, Society

Using the proper Section for the fixture selected, the Mounting Height decided upon and the Conditions Factor (found in Table II), choose such Lamp Size and Spacing as will give the desired Foot-Candles.

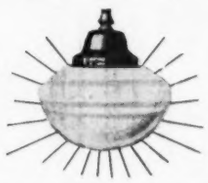
SECTION 1



SECTION 2



SECTION 3†



Area Per Outlet Adequately Lighted or *Approximate Spacing	Distance from Underside of Reflector to Floor to be not less than	Conditions Factor	Average Foot-Candles					Average Foot-Candles						Average Foot-Candles				
			100 Watt	150 Watt	200 Watt	300 Watt	500 Watt	100 Watt	150 Watt	200 Watt	300 Watt	500 Watt		100 Watt	150 Watt	200 Watt	300 Watt	500 Watt
55-65 Sq. Ft. or 7½'x7½' Spacing	7' 6"	Favorable	8-10	15-18	21-26	.....	.....	7-9	13-16	18-23	.....	.....		7-9	10-14	15-22	.....	.....
		Average	6-8	11-15	16-21	.....	.....	5-7	10-13	14-18	.....	.....		5-6	7-10	11-15	.....	.....
		Unfavorable	5.5-6.5	9-11	13-16	.....	.....	4.5-5.5	8-10	11-14	.....	.....		3-4	4-6	7-9	.....	.....
65-75 Sq. Ft. or 8½'x8½' Spacing	8' 6"	Favorable	7-9	13-16	18-22	.....	.....	6-8	11-14	15-19	.....	.....		6-7	9-13	13-19	.....	.....
		Average	6-7	10-13	13-18	.....	.....	5-6	8-11	11-15	.....	.....		4.5-5.0	6-9	9-13	.....	.....
		Unfavorable	5-6	8-10	11-13	.....	.....	4-5	7-8	9-11	.....	.....		2.5-3.0	4-6	6.5-8.0	.....	.....
75-85 Sq. Ft. or 9'x9' Spacing	8' 6"	Favorable	6-8	11-14	15-19	.....	.....	5-7	10-12	13-17	.....	.....		5-6	8-11	11-17	.....	.....
		Average	5-6	8-11	12-15	.....	.....	4-5	8-10	10-13	.....	.....		4.0-4.5	5-8	8-11	.....	.....
		Unfavorable	4-5	7-8	10-12	.....	.....	3.5-4.0	6-8	8-10	.....	.....		2.5-3.0	3.5-5.0	6-7	.....	.....
85-95 Sq. Ft. or 9½'x9½' Spacing	9' 0"	Favorable	5-7	10-12	14-17	.....	.....	5-6	8-10	12-15	.....	.....		4.0-5.5	7-10	10-14	17-24	.....
		Average	4-5	8-10	11-14	.....	.....	3.5-4.5	6-8	9-12	.....	.....		3.5-4.0	5-7	7-9	11-17	.....
		Unfavorable	3.5-4.0	6-8	9-11	.....	.....	3.0-3.5	5-6	7-9	.....	.....		2.0-2.5	3-4	5-6	7-11	.....
95-110 Sq. Ft. or 10'x10' Spacing	9' 6"	Favorable	4-6	8-10	12-15	21-26	.....	4-5	7-9	11-13	18-23	.....		3.5-5.0	6-9	9-12	15-21	.....
		Average	3.5-4.0	6-8	10-12	16-21	.....	3-4	5-7	8-11	13-18	.....		3.0-3.5	4-6	6-8	9-15	.....
		Unfavorable	3.0-3.5	5-6	8-10	13-16	.....	2.5-3.5	4-5	6-8	11-13	.....		1.5-2.0	2.5-4.0	4.5-5.0	6-9	.....
110-125 Sq. Ft. or 11'x11' Spacing	10' 0"	Favorable	4-5	7-9	10-13	18-22	.....	3.5-4.0	6-8	9-11	15-19	.....		3-4	5-7	8-11	13-19	.....
		Average	3.5-4.0	6-7	8-10	14-18	.....	3.0-3.5	5-6	7-9	11-15	.....		2.5-3.0	4.5-5.0	5.5-7.0	8-13	.....
		Unfavorable	2.5-3.5	5-5.5	7-8	12-14	.....	2.5-3.0	4-5	5-6	9-11	.....		1.5-2.0	2.5-3.0	4.0-4.5	6-8	.....
125-145 Sq. Ft. or 11½'x11½' Spacing	10' 6"	Favorable	3.5-4.0	6-8	9-11	15-19	.....	3.0-3.5	5-7	8-10	13-17	.....		2.5-3.5	5-6	7-9	11-16	.....
		Average	3.0-3.5	5-6	7-9	12-15	.....	2.5-3.0	4-5	6-8	10-13	.....		2.0-2.5	3.5-4.5	5-6	7-11	.....
		Unfavorable	2.5-3.0	4-5	6-7	10-12	.....	2.0-2.5	3-4	4.5-5.5	8-10	.....		1.0-1.5	2-3	3.5-4.0	5-7	.....
145-170 Sq. Ft. or 12½'x12½' Spacing	11' 6"	Favorable	3.0-3.5	5-7	7-9	13-17	.....	2.5-3.0	4-6	6.5-8	12-15	21-26		2-3	3.5-5.0	6-8	9-14	17-25
		Average	2.5-3.0	4-5	6-7	10-13	.....	2.0-2.5	3-4	5-6	9-12	16-21		1.5-2.0	3.0-3.5	4.5-5.0	6-9	11-17
		Unfavorable	2.0-2.5	3.5-4.0	5-6	8-10	.....	1.5-2.0	2.5-3.5	4-5	7-9	13-16		0.5-1.0	1.5-2.5	3.0-3.5	4-6	7-11
170-200 Sq. Ft. or 13½'x13½' Spacing	11' 6"	Favorable	2.5-3.5	4-6	6-8	11-14	20-25	.....	3.5-5.0	6-7	10-12	18-23		1.5-2.5	4-5	5-6	8-11	14-21
		Average	2.0-3.0	3.5-4.0	5-6	8-11	16-20	.....	3.0-3.8	4-5	7-10	13-18		1.0-1.5	2.5-3.0	4.0-4.5	5-8	9-14
		Unfavorable	1.5-2.0	3.0-3.5	4-5	7-8	13-16	.....	2.5-3.0	3.5-4.0	6.5-7.5	10-13		.....	1.5-2.0	2.5-3.0	3.5-5.0	6-9
200-230 Sq. Ft. or 14¾'x14¾' Spacing	12' 6"	Favorable	2.5-3.0	3.5-4.0	5-7	10-12	17-22	.....	3.5-4.0	5-6	8-10	15-19		.....	3-4	4-5	7-10	12-18
		Average	2.0-2.5	3.0-3.5	4.5-5.5	7-10	13-17	.....	2.8-3.5	3.5-4.0	6.5-8	11-15		.....	2.0-2.5	3.5-4.0	4-7	8-12
		Unfavorable	1.0-1.5	2.5-3.0	3.5-4.0	6-7	11-13	.....	2.0-2.5	3.0-3.5	5.5-6.5	9-11		.....	1.0-1.5	2.0-2.5	3-4	5-8
230-260 Sq. Ft. or 15½'x15½' Spacing	13' 0"	Favorable	.....	3.0-3.5	4-6	8-10	15-19	.....	3.0-3.5	4-5	7.5-9	13-17		.....	2.5-3.5	3.5-4.0	6-9	10-14
		Average	.....	2.5-3.0	4-4.5	6-8	12-15	.....	2.5-3.0	3-4	6-7	10-13		.....	1.5-2.0	3.0-3.5	3.5-6.0	7-10
		Unfavorable	.....	2.0-2.5	3.5-4.0	5.5-6.5	10-12	.....	1.5-2.0	2.5-3.0	4.5-5.5	8-10		.....	1.0-1.5	1.5-2.0	2.0-3.5	5-7
260-300 Sq. Ft. or 16¾'x16¾' Spacing	13' 6"	Favorable	.....	2.5-3.0	4-5	7-9	13-17	.....	2.5-3.0	3.5-4.0	7-8	12-15		.....	2-3	3-4	5-7	9-13
		Average	.....	2.0-2.5	3.5-4.0	6-7	10-13	.....	2.0-2.6	3.0-3.5	5-6	9-12		.....	1.0-1.5	2.5-3.0	3-5	6-9
		Unfavorable	.....	1.5-2.0	3.0-3.5	5-6	9-10	.....	.....	2.0-2.5	4-4.5	7-9		.....	.....	1.0-1.5	2.5-3.0	4-6
300-340 Sq. Ft. or 18'x18' Spacing	14' 6"	Favorable	.....	.....	3.5-4.0	6-8	12-14	.....	.....	3.0-3.5	5-7	10-12		.....	.....	3-4	4-6	8-10
		Average	.....	.....	3.0-3.5	5-6	9-12	.....	.....	2.5-3.0	4-5	8-10		.....	.....	2.0-2.5	3-4	5-8
		Unfavorable	.....	.....	2.5-3.0	4-5	7-9	.....	.....	1.5-2.0	3.5-4.0	6-8		.....	.....	.....	2.5-3.0	3.5-5.0
340-390 Sq. Ft. or 19'x19' Spacing	15' 6"	Favorable	.....	.....	3.0-3.5	5-7	10-12	.....	.....	2.5-3.0	4.5-6	9-11		.....	.....	2.5-3.0	3.5-4.5	7-10
		Average	.....	.....	2.5-3.0	4-5	7-10	.....	.....	2.0-2.5	3.5-4.0	7-9		.....	.....	1.5-2.0	2.5-3.5	4-7
		Unfavorable	.....	.....	2.0-2.5	3.5-4.0	6-7	.....	.....	.....	3.0-3.5	5.5-6.5		.....	.....	.....	2.0-2.5	3-4
390-440 Sq. Ft. or 20½'x20½' Spacing	16' 6"	Favorable	.....	.....	2.5-3.0	4-6	9-11	.....	.....	.....	4-5	8-10		.....	.....	2.0-2.5	3-5	6-9
		Average	.....	.....	2.0-2.5	3.5-4.0	7-9	.....	.....	.....	3-4	6-8		.....	.....	1.0-1.5	2.0-3.5	4-6
		Unfavorable	.....	.....	1.5-2.0	3.0-3.5	5-6	.....	.....	.....	2.5-3.0	5-6		.....	.....	.....	1.5-2.0	3-4
440-500 Sq. Ft. or 21¾'x21¾' Spacing	17' 0"	Favorable	.....	.....	.....	4-5	8-10	.....	.....	.....	3.5-4.0	6-8		.....	.....	1.5-2.5	3-4	5-8
		Average	.....	.....	.....	3.0-3.5	6-8	.....	.....	.....	2.5-3.5	5-6		.....	.....	.....	2-3	3-5
		Unfavorable	.....	.....	.....	2.5-3.0	4-5	.....	.....	.....	2.0-2.5	4-5		.....	.....	.....	.....	2.5-3.0

Mount Units 12' High Wherever Possible

* Between walls and first rows of lights allow not more than ½ spacing.

†Ordinarily, use an overall fixture length of ¼ the ceiling height.

Room and Maintenance Conditions

The importance of correctly rating the room and maintenance conditions is ndicated by observing that in each case for a given size of lamp and area per outlet —in other words, for a given watts per square foot—the illumination may vary by as much as three to one, depending upon whether the conditions are favorable or unfavorable.

Proportions of Room	Color of Ceiling and Upper Side Walls	Conditions Factor: For Direct Lighting (Group A, B, C Fixtures) — Maintenance of Equipment: Very Good	Fair	For Indirect Lighting (Group D, E Fixtures) — Maintenance of Equipment: Very Good	Fair
Width approximately four or more times ceiling height	Light	Favorable	Favorable	Favorable	Favorable
	Medium	Favorable	Favorable	Favorable	Average
	Dark	Favorable	Average	Unfavorable	Unfavorable
Width approximately twice ceiling height	Light	Favorable	Average	Favorable	Average
	Medium	Favorable	Average	Average	Unfavorable
	Dark	Average	Unfavorable	Unfavorable	Impracticable
Width approximately equal to ceiling height	Light	Average	Unfavorable	Average	Unfavorable
	Medium	Unfavorable	Unfavorable	Unfavorable	Impracticable
	Dark	Unfavorable	Unfavorable	Unfavorable	Impracticable

Organized for Operating in Sparsely Settled Country

By A. R. Battern

Iowa Public Service Company, Sioux City, Iowa

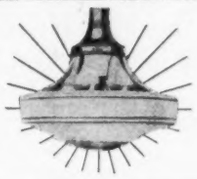
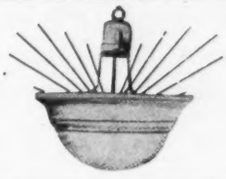
An area of approximately 20,000 square miles is served by the Iowa Public Service Company, with 50,000 customers located in 200 towns, only one of which has more than 6,000 population. Organizing the operating department of this company presented a problem different from what is usually encountered due to the relatively light load and the extensive area covered. The organization plan which was put into operation is based on a number of factors, of which the following are outstanding:

1. On account of the relatively high investment per kilowatt-hour output operating costs must be low if rates are to be comparable to rates in larger places.

2. Only a few generating stations can be operated if production costs are to be kept within reasonable limits. The

Types of Equipment

for Electrical Development)

SECTION 4†					SECTION 5†				
									
Average Foot-Candles					Average Foot-Candles				
100 Watt	150 Watt	200 Watt	300 Watt	500 Watt	150 Watt	200 Watt	300 Watt	500 Watt	1000 Watt
5-7 3-5 2.5-3.0	9-12 6-9 4-6	13-18 8-13 5-8	22-30 14-22 10-14	.....	6-10 4-6 3-4	9-14 5-9 4-5	15-24 9-15 7-9	.....	.....
4-6 3-4 2-3	8-11 5-8 3.5-5.0	11-15 7-11 5-7	19-25 12-19 8-12	.....	5-8 3-5 2.5-3.0	7-12 5-7 3-5	13-20 8-13 6-8	.....	.....
3.5-5.0 2.5-3.5 1.5-2.5	7-9 4-7 3-4	8-12 6-8 4-6	16-22 10-16 7-10	.....	5-7 3-5 2-3	7-11 4-7 3-4	11-18 7-11 5-7	.....	.....
3-4 2-3 1.5-2.0	6-8 4-6 2.5-4.0	8-11 5-8 4-5	14-19 9-14 6-9	.....	4-6 2.5-4.0 2.0-2.5	5-9 3.5-5.0 3.0-3.5	10-14 7-10 5-6	.....	.....
3.0-3.5 2.0-2.5 1.5-2.0	5-7 3-5 2.5-3.0	7-10 5-7 3.5-5.0	12-17 8-12 5-8	23-31 15-23 10-15	3.5-5.0 2.0-3.5 1.5-2.5	5-8 3-5 2.5-3.0	9-14 5-9 4-5	16-25 10-16 7-10	.....
2.5-3.5 1.5-2.0 1.0-1.5	4-6 3-4 2-3	6-9 4-6 3-4	11-15 7-11 5-7	20-27 13-20 9-13	3-5 2-3 1.5-2.0	4-7 2.5-4.0 2.0-2.5	7-12 4-7 3.5-4.0	14-22 8-14 6-8	31-50 18-31 13-18
2-3 1.0-1.5	3.5-5.0 2.5-3.5 1.5-2.5	5-7 3.5-5.0 2.5-3.5	9-13 6-9 4-6	17-23 11-17 8-11	2.5-4.0 1.5-2.5 1.0-1.5	3.5-5.0 2.0-3.5 1.5-2.5	6-10 4-6 3-4	11-18 7-11 5-7	25-40 16-25 11-16
....	3.5-4.0 2.0-3.5 1.5-2.0	4-6 3-4 2-3	8-11 5-8 3.5-5.0	15-20 9-15 6-9	2.5-3.5 1.5-2.0	3-5 2-3 1.5-2.0	5-9 3-5 2.5-3.0	10-16 6-10 5-6	22-36 13-22 11-13
....	3-4 1.5-3.0 1.0-1.5	3.5-5.0 2.0-3.5 1.5-2.0	7-9 4-7 3-4	12-17 8-12 5-8	....	2.5-4.0 1.5-2.5 1.0-1.5	5-7 3-4 2-3	8-13 5-8 4-5	18-29 11-18 9-11
....	2.5-3.5 1.5-2.5	3.5-4.0 2-3 1.5-2.0	6-8 4-6 2.5-4.0	10-14 7-10 5-7	....	2.5-3.0	4-6 2.5-4.0 2.0-2.5	7-11 4-7 3.5-4.0	16-25 9-16 8-9
....	2-3 1.5-2.0	3-4 2.0-2.5 1.5-2.0	5-7 3-5 2.5-3.0	9-12 6-9 4-6	....	2-3	3.5-5.0 2.0-3.5 1.5-2.0	6-10 4-6 3-4	13-22 9-13 7-9
....	....	2.5-3.0 1.5-2.0 1-2	4-6 3-4 2-3	8-11 6-8 3-4	....	1.5-2.5	3-5 2-3	5-9 3-5 2.5-3.0	11-20 7-11 5.5-7.0
....	....	2-3 1.0-1.5	3.5-5.0 2.5-3.5 1.5-2.5	7-9 5-7 3-5	....	....	2.5-4.0 1.5-2.5	5-7 3-4 2.0-2.5	11-16 7-9 4.5-5.5
....	....	....	3-4 2-3 1.5-2.0	6-8 4-6 3-4	....	....	....	4-6 2.5-4.0 1.5-2.0	9-13 5.5-9.0 3.5-4.5
....	....	....	3-4 1.5-3.0 1.0-1.5	5-7 3.5-5.0 2.5-3.5	....	....	....	3.5-5.0 2.0-3.5 1.0-1.5	8-11 4.5-8.0 2.0-3.5
....	....	....	2.5-3.5 1.5-2.5	4-6 3-4 2-3	....	....	....	3-5 2-3	7-11 4.5-7.0 1.0-2.5

majority of towns must therefore depend upon transmission line service entirely.

3. Quality of service cannot be sacrificed because the towns are small. Therefore transmission lines must be of high grade type and the organization must be able promptly to take care of any trouble which might develop.

4. Best and lowest cost service can be rendered by having the company's strength close to the operating problem.

In order to carry out this policy the company is divided into four divisions for operating purposes, and each division is subdivided into approximately ten districts, making a total of 40 operating bases.

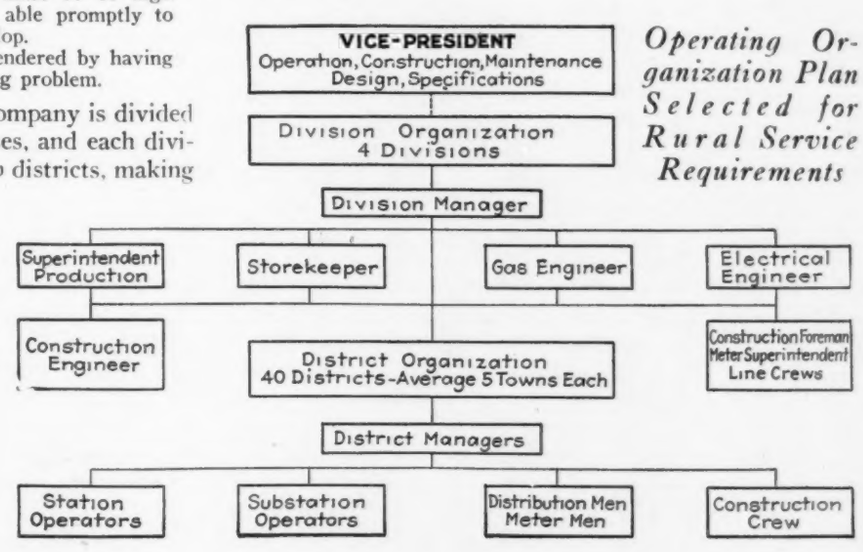
The general office directs all four divisions and the organization consists of the vice-president in charge of operation and maintenance and his staff. Since the divisions take care of the execution of all work, this office is manned with a very small personnel, sufficient only for defining operating policies, checking division plans, general design and specifications, and purchases. Each division has an operating organization with the division manager in charge and directs all operating and construction matters in the districts. The organization chart shows the arrangement.

Each district, of which there are 40, includes an average of five towns and an area of 500 square miles, making about one per county. The manager takes care of all construction and operating matters except the large transmission and station construction jobs, which are handled direct by the division organization. The company's experience indicates that the rendering of good service at lowest cost requires that each district be operated on a nearly self-supporting basis. Each district has linemen and line cars to take care of all ordinary construction and maintenance. High-voltage lines are patrolled, trees trimmed and a constant effort made to locate hazardous conditions before trouble develops. The size of the traveling construction crew of each division depends upon the job at hand. Each gang is maintained the year around with a small nucleus of skilled linemen and labor is added and released as required.

Work Order System

A system of work orders is used. In order that the board of directors may approve all large jobs an approved work order must be obtained before any work is started. In order that the district manager may be in position to take care of the requirements of any customer promptly, blanket work orders are approved for each calendar year covering meters, transformers, services and short line extensions for new business.

A set of standard construction specifications and material lists is used by all districts. This results in uniform construction practices and a reduced number of items to carry in stock. The standard list of material includes the principal construction items. This list is revised about twice a year and an effort is made to keep the number of items as small as possible and yet make the list flexible. Items such as poles, hardware, crossarms, etc., may be purchased from any manufacturer. All purchases are made through the purchasing agent of the general office. No material is kept in stock for large construction jobs. Material is stocked only for ordinary distribution jobs and maintenance. On account of the many locations the investment in material stocks is a perplexing problem and in general it has been found cheaper to buy many items in small quantities from jobbers for shipment direct to the district than to buy in carload lots from manufacturers.

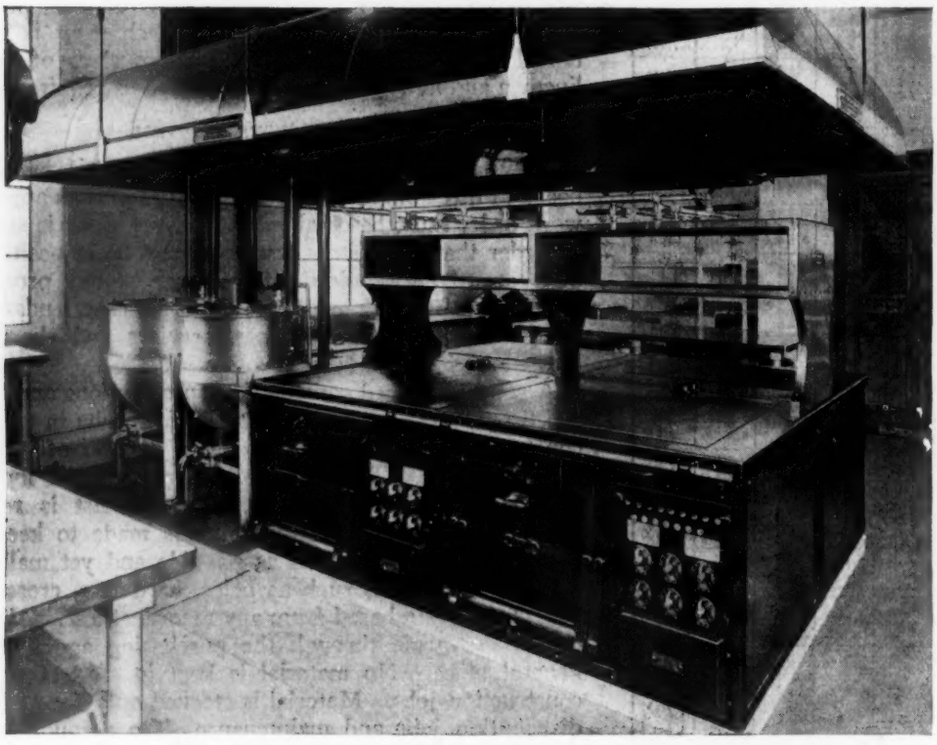


Operating Organization Plan Selected for Rural Service Requirements

Commercial Baking and Cooking

Development of large field awaits intelligent sales efforts by utilities. Co-operation with bakery and kitchen equipment manufacturers necessary. Experience data available for sales assistance

By ODIN WILHELMY
Chairman Commercial Cooking Committee, Commercial National Section, N.E.L.A.



A Modern Electric Kitchen in an Educational Institution

THE bread baking industry has advanced in five years from the position of twenty-third to seventh in the rating of size of industries in the United States. Bakers are now producing about 55,000,000 lb. of bread a day, not taking into account the enormous quantities of cakes, cookies, crackers, pies and pastries of all kinds. Assuming an average baking economy of approximately 100 kw.-hr. per 1,000 lb. of bread baked, there is a potential possibility of selling 5,500,000 kw.-hr. per day for bread baking alone. Surely here is a business that commands the attention of every commercial executive of the electrical industry.

Today there are about 35 electric traveling ovens in use and about 4,000 electric peel type ovens. There should be many more. The pioneering has been done, the equipment is available, the sales information is at hand, the electric oven has proved its value to both the baker and to the power company—the future growth in the use of these ovens depends upon how well the oven manufacturers and the power companies co-operate.

To repeat, here is a potential load of 5,500,000 kw.-hr. per day in bread baking alone and the field is widespread. But we are not going to get this load merely for the asking. It must be sold, and it is only through intelligent co-operation of oven manufacturers and power companies that real progress will be accomplished. What are the fundamentals of this co-operation and how to go about it?

First of all, let it be said that no power company can expect oven manufacturers to come into its territory and play a lone hand in the sale of electric ovens. The manufacturer must know that the power company appreciates the value of this load, has rates that make it attractive to the customer, is anxious to have the load on its lines and is willing to meet the manufacturer and the prospective customer half way in the sale of the equipment.

In order to be able to co-operate with the manufacturer in the sale of ovens, the power company must know the potential prospective customers in its territory, and this should be the job of one individual in the sales department. This individual should be responsible for a survey of the territory, for complete knowledge of its possibilities and for preliminary contacts with potential customers. It is to this individual that the oven builder shall turn for all power company co-operation in the sales of ovens. He is their friend in court and makes this business his business.

With complete knowledge of the territory the prospects can be divided into potential users of traveling ovens or stationary peel type ovens. Nearly all bakers producing 10,000 to 12,000 or more loaves of bread per day may be considered as prospects for a traveling oven. Bakers generally are easily sold on the idea of the traveling oven, but it must be proved to them that electric heat can be used economically in this type of equipment.

The maker will want to know definitely all about the electric oven that is proposed and he will expect, from the oven builder, a complete proposition covering oven

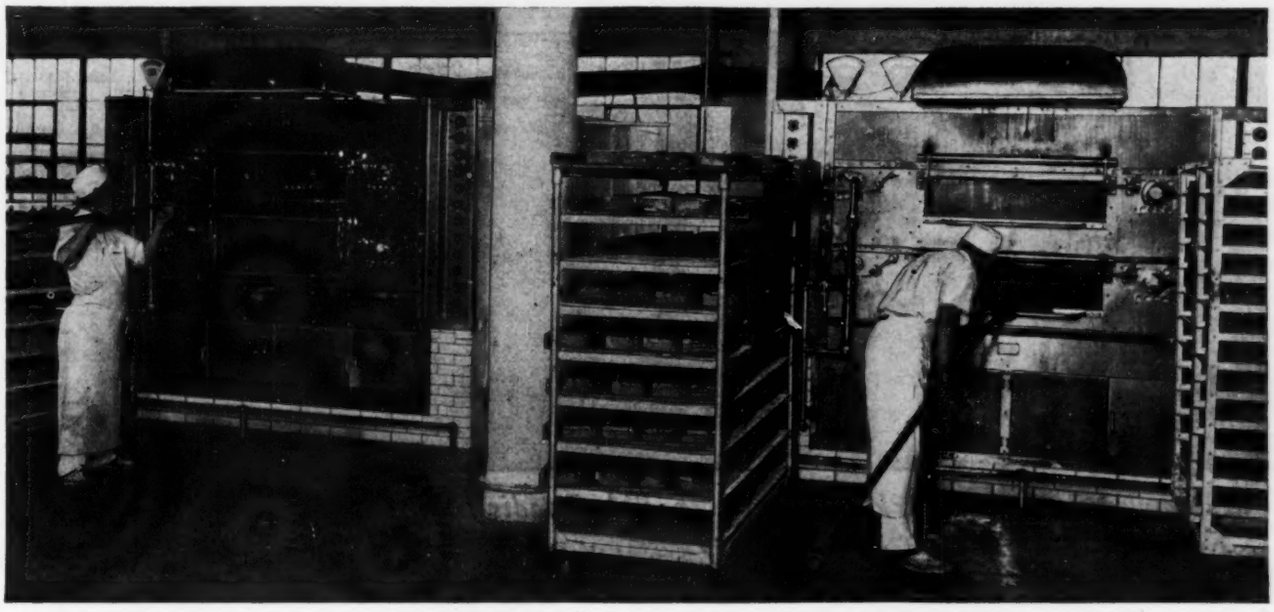
specifications and purchase and installation costs, performance guarantees and operating costs. The oven builder will present such a proposition, but in order to be able to do so, he must have complete details as to the kinds of products baked and the quantities of each, the sizes and weights of pans used, the baking temperatures, the hours of operation, the electric rate to be applied, etc. In gathering this information the power company salesman can assist materially and, with all of the detailed information at hand, the oven builder will present a complete proposal either directly or through the power company, as local conditions may dictate. This makes possible an intelligent decision.

Let us consider in greater detail the advantages of the electric oven over fuel-fired equipment. First there is the matter of convenience, which will appeal at once to every baker. Picture to him the starting of an electric oven by the pushing of a button or the throwing of a switch and contrast this with the lighting and regulation of fires or burners in starting fuel-fired ovens and the subsequent removal of ashes and cleaning of grates in the case of solid fuels or the cleaning of burners in the case of liquid or gaseous fuels. Intimately associated with the matter of convenience is the question of the personal comfort of the baker and his employees. The maximum temperature in an electric oven is the baking temperature, whereas in fuel-fired ovens the temperature of combustion of the fuel (2,000 deg. to 3,000 deg. F.) is far in excess of the baking temperature. The excess heat has to be dissipated in one way or another and the tendency is to heat the bake shop and make it uncomfortable for the workmen, thus lowering their efficiency and morale. Again, the combustion of the fuel vitiates the air in the shop and further lowers the productivity of the workmen, and, incidentally, the profits of the owner.

All too frequently do we learn of the explosion of fuel-fired ovens with consequent damage to life and property and the resultant loss of production—and profits. In the matter of safety the electric oven is pre-eminent, and this factor alone will command the baker's attention. That this element of danger does exist in fuel-fired ovens can readily be substantiated by a study of the pamphlet entitled "Precautions and Safeguards for Gas-Heated Traveling Ovens," published by the Association of Factory Mutual Fire Insurance Companies. That fuel-fired ovens do not explode more frequently than they do is a tribute to the care exercised by the users, but surely the baker would be glad to be relieved of this danger and anxiety.

Heat control in the electric oven is positive and the electric oven will produce a more uniform product day in and day out with a minimum of labor and supervision. This means a greater production of salable product at a reduced operating cost and, again, more profits for the baker.

Take note of how everything is done in the modern bakery to keep the place and the product clean. This is done partly because of health department regulations and partly because of the appeal of the clean shop to the customers and the consequent effect on sales. The electric oven makes this job of keeping the shop clean infinitely easier. The shop is kept spick-and-span with little effort and the food products leave the plant cleaner, more appetizing and more appealing to the purchaser, all of which means additional profits.



Two 400-Load Double-Deck Ovens for Bread, Cake and Sweet Goods

The heating elements, the wiring, the control equipment of electric ovens have durability that will outwear the ordinary parts of the oven. There is no reason why they need be made delicate nor why they should be short-lived, and on that account maintenance costs will be kept down to a minimum—decidedly less than is the case with fuel-fired ovens. Again more profits for the baker.

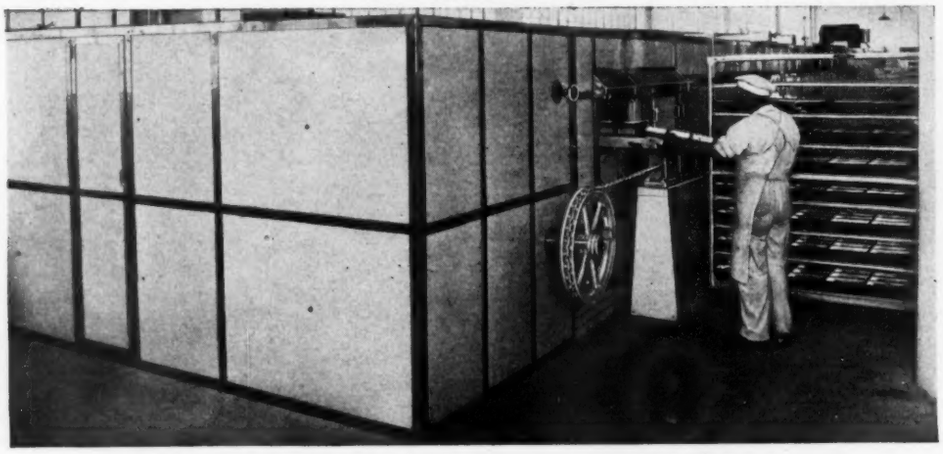
Although the question of insurance must still be determined in each individual case, it is probable that in most instances there will be a reduction of insurance rates to the user of electric ovens due to the absence of the fire and explosion hazard. Credit the saving to more profits.

And to top off all these advantages, the purchase price of a first-class electric traveling oven will, in most instances, be less than for a modern fuel-fired traveling

oven and total operating costs will equal and, in some cases, be even lower with the electric oven than with the equipment previously employed. Add to this an improved product and increased sales and the baker has increased profits that will make the electric oven a highly desirable investment. With this array of advantages and the help of the oven manufacturer at hand every power company should take definite action to promote the sale of the electric traveling oven.

In the United States as a whole there are more than 150,000 institutions, such as bakeries, hotels, clubs, restaurants, cafeterias and other eating places, that are prospects for the sale and use of commercial cooking and baking equipment. When it is realized that just an average size installation of this equipment will consume monthly the amount of energy used by 175 residential customers, then can be appreciated the tremendous volume of business that can be built up by organizing to campaign for the commercial cooking and baking load.

As for merchandise sales, more than $10,000,000 worth of commercial cooking and baking equipment is purchased annually. Of this $5,000,000 worth is electrical.



Automatic Traveling Deck Electric Oven, Side Loading Type for Bread Baking

There are fifteen prospects for the sale of commercial cooking and baking equipment for every 5,000 population served on the power companies' lines. In the states of Ohio, Kentucky and West Virginia there are 30,000 potential customers. The equipment will consume 2,000 kw.-hr. per year per kilowatt connected. If only 10 per cent of this market is sold each year and if the average additional load is only 10 kw. per customer there would result 60,000,000 kw.-hr. additional consumption annually.

To satisfy themselves on the desirability of the load, power companies which first pioneered in selling this equipment made surveys to determine the following:

What time of day load was on; would the load come on during the lighting peak; what load factor could be derived; could the energy be sold at a rate that was attractive to the customer; the cost of securing this type of load, and how the service company should proceed to secure the load. Now, after fifteen years of experience, a fund of knowledge and data have been obtained by making actual surveys which answer all of these questions most favorably for the power company.

What Time of Day Load Is On.—The bake oven is particularly desirable in this respect, being used late at night and early in the day. The hotel with an electrified kitchen and bake shop has proved to be an ideal load. Here is continuous use of current during the full 24-hour period, seven days a week and 365 days in the year. The baking is done after midnight and during the early morning. The cooking operation starts in the early morning and continues during the day and all the heavy cooking is out of the way by 4 o'clock in the afternoon. By the time the lighting load comes on, the baking load has been off for several hours and the cooking load has been reduced to a low demand. The current consumption is just about doubled in the hotel without increasing the demand.

What Load Factor Could Be Derived.—Exhaustive surveys made on institutions before and after electric equipment has been installed determine that the load factor is improved on an average of 30 per cent. Before electrifying the kitchen of a hotel the monthly kilowatt-hour consumption amounted to 87,239, with a maximum demand of 390 kw., and this demand occurred between 7 and 8 p.m. The load factor was 31 per cent. After adding the cooking and baking load of 238 kw., the monthly energy consumption increased to 116,090 kw.-hr. The maximum demand increased only 10 kw. and the load factor was improved to 40.6 per cent. Thus it is seen that the commercial cooking equipment increased the load factor practically one-third and the energy consumption was increased 28,851 kw.-hr. per month with little increase in demand.

Can the Energy Be Sold at a Rate that Is Attractive to the Customer?—It has been found that a lower rate for electricity will not alone create a boom for electrical devices, nor will a relatively higher rate prohibit their sale. One kilowatt-hour will bake twelve pounds of bread or cook two meals. An electric rate of 2½ per cent net per kilowatt-hour will usually work out favorably against gas at $1 per thousand (550 B.t.u.) or coal at $15 per ton for hotels and small bakeries. If the power company will extend a rate equivalent to the above equation the commercial cooking and baking load can be obtained with assurance and confidence established with the user that his electric cooking and baking cost will be in close relation to competitive fuel costs.

The Cost of Securing This Type of Load.—Over 90 per cent of the institutions which are prospects are located in commercial districts where additional revenue can be obtained without increasing system investment. In the hotel and hospital it is found that the equipment operates at such times as to need no larger feeders or substation transformers than used for the regular load and about the only additional expense required is for metering equipment. There is a substantial sales profit, which more than makes up for the selling expense involved in promoting the use of this equipment.

There is a great deal of data available from actual survey records in the report of the commercial cooking committee of the N.E.L.A. Numerous installations are cited, such as the following:

A Hotel Installation

Connected load, kw	215
Average demand, kw	105
Average annual consumption, kw.-hr.	356,090
Load factor, per cent	39
Cost of connecting this load	$1,485.40
(This includes the complete transformer and metering equipment for the hotel, most of which would have been necessary even though the commercial cooking load had not been added.)	
Average annual revenue from the commercial cooking load	$7,482.20

The cost of connecting this installation amounted to only $6.90 per kilowatt connected, which is less than one-fifth of the annual energy revenue. This installation returns to the central station a revenue of $70 per year per kilowatt of demand.

How the Service Company Should Proceed to Secure This Load.—Definite steps should first be taken to make a thorough and exhaustive survey of the potential market in the territory for bake ovens and other equipment. In connection with the survey, it is quite necessary that an analysis of electric rates and competitive fuel costs be made in order to determine what units of electric equipment should be sold and can be operated economically. The best results have been obtained by having a trained sales specialist devote his full time to the sale of commercial cooking and baking equipment. The sales specialist should first, last and all the time be a real salesman. It is not necessary that he be an engineer, but he should be thoroughly familiar with rate schedules and with equipment available.

The baking industry undoubtedly offers the most readily accessible market for both commercial sales of bake ovens and additional energy consumption by their use. Through 75 years in this country the baking business has never had a setback. It has never failed to show an increase from year to year. Twenty years ago 75 per cent of the baking was done in the home. Today more than 65 per cent is being done in the bake shop. Thus can be seen the tendency stimulating the growth and expansion of the large as well as the small neighborhood bake shop. The hotel, restaurant and hospital fields offer just as attractive a market for the sale of equipment and the additional use of current.

The writer is indebted for much of the information and material contained in this article to Grant Call of the Edison Electric Appliance Company, to R. M. Crawford of the Crawford Oven Company and to C. B. Eggert of the Baker Perkins Company.

Letters from Our Readers

Supports Direct-Current Testing of Insulation

In the June 1 issue of the ELECTRICAL WORLD there appears on page 1087 an article under the heading "Alternating-Current and Direct-Current Tests of Insulation." This article deals with an "old problem" as stated, but is so stated as to cause one to think, if not believe, that the use of direct current for insulation test purposes was of such doubtful value as to prevent any consideration of it whatsoever.

We think that it is a mistake to so present the case to the reading public. We believe that the value of insulating materials can best be determined by the use of direct current. We also agree that such values may require interpretation for alternating-current tests.

It is quite evident that direct current imposes less hardship upon insulation than alternating current does; this does not, however, preclude the possibility of learning the true insulating value of any material selected for trial or test. After having learned the true characteristics of such material with direct current, it should then become very easy, or at least a near-easy matter, to determine what to expect when alternating current is applied.

For low voltages the insulating problem is mainly a mechanical one, whereas high voltages require special attention to the problem as an insulation, one with the mechanics playing a secondary part.

It is the writer's opinion that direct current will play the more important part in determining the fundamental values of insulating materials, and we are further of the opinion that colleges doing experimental work could well take up such investigations.

Scotia, N. Y. H. L. SCHERMERHORN.

Electric Traveling Oven Installations

Name of Bakery	Location	Electric Traveling Oven Used	Capacity	Connected Load, Kw.
American Stores	Philadelphia	1—Baker Perkins	5,500 lb. per hour	550
		2—Crawford	4,000 lb. per hour	408
First National Stores	Summerville	2—Baker Perkins	110 ft. x 9 ft.	Each 590
Fisher Brothers	Cleveland	1—Crawford	40 ft. x 9 ft.	200
Fisher Brothers	Cleveland	1—Baker Perkins	80 ft. x 9 ft.	476
General Baking Company	Charleston	1—Crawford	110 ft. x 9 ft.	648
Koehler & Fretz	Lansdale, Pa.	1—Baker Perkins	50 ft. x 6 ft. 4 in.	210
Cushman Baking Company	Lynn, Mass.	1—Edison	2,600 lb. per hour	...
General Baking Company	New York	1—Comstock	...	...
General Baking Company	New York	2—Crawford	...	...
General Baking Company	Brooklyn	1—Crawford	4,500 lb. per hour	550
Huber Baking Company	Wilmington	1—Baker Perkins	...	...
General Baking Company	Jersey City	2—Crawford	...	...
Manbeck Baking Company	Hagerstown, Md.	1—Baker Perkins	...	...
Continental Baking Company	Hartford, Conn.	1—Baker Perkins	4,000 lb. per hour	405
Reymond Baking Company	Waterbury, Conn.	1—Baker Perkins	1,500 lb. per hour	216
Cortland Baking Company	Cortland, N. Y.	1—Crawford	2,000 lb. per hour	300
Tasty Baking Company	Philadelphia	4—Crawford	4,000 lb. per hour	405
American Stores	Philadelphia	2—Crawford	4,000 lb. per hour	Each 408
Ward Baking Company	Philadelphia	1—Crawford	2,750 lb. per hour	250
Horn & Hardart	Philadelphia	1—Crawford	2,750 lb. per hour	250
Geo. W. Cramer Baking Company	San Diego	1—Rainier	1,800 lb. per hour	250
American Lady Bakery	Salt Lake	1—Rainier	2,500 lb. per hour	220
Mutual Creamery	Oakland	1—Baker Perkins	60 ft. x 9 ft.	330
Nurmi Creamery Company	Fresno	1—Rainier	...	...
Haynes-Foster	Portland	1—Rainier	...	...
Kremmel's Bakery	Eugene, Ore.	1—Rainier	...	...
(Not known)	Phoenix, Ariz.	1—Schaller	...	...

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Pulverized-Coal Firing—A description of a unit pulverizing machine which, in connection with a well-known flare-type burner, is claimed fully to meet the requirements for pulverized-fuel firing in a generating station. The assembly dries the coal, pulverizes it and fires it in a single self-contained unit. Performance data have been included, as has a description of the operation of the device and its installation in several British power stations.—*Electrical Review (England)*, June 7, 1929.

Generation, Control, Switching and Protection

Caloric Power Station Schulau.—A. MILICH and W. PETERSEN.—The growing light and power demand of the German city Altona forced the municipality to build a new steam power station, since an addition to the existing plant did not seem feasible. A modern high-pressure station was erected, comprising one 17,000 and one 28,000 kw. turbine set, with room provided for a second 28,000. The article covers only the economical phase of the new enterprise and the steam technical part. The great value of the paper lies, however, in the detailed description of the reasons for arriving at the size of machines and the chosen steam pressure by properly interpreting the existing and probable future load of the city. The largest part of the generated energy is delivered to the city through two underground three-phase, 60-kv. cables of 9½ miles length. — *Elektrotechnische Zeitschrift*, May 2, 1929.

Transmission, Substations and Distribution

Design Features of the Toronto-Leaside Station.—C. F. PUBLOW and G. E. KEWIN.—The Toronto-Leaside 220,000-volt transformer station of the Hydro-Electric Power Commission of Ontario consists of a 220-kv. switching unit, the transformer equipment and switching apparatus. The 220-kv. area, which is of the outdoor type of construction, consists of the bus and switching equipment between the incoming line and the transformers. The 220-kv. disconnecting switches are of the high-pressure contact type and are rated at 1,000 amp. They are motor operated and when used as isolating switches on an oil breaker the two sets of switches operate together from one control. Electrical interlocks are provided between the breaker and disconnecting switch controls so that the disconnecting switches cannot be opened under load. Two banks of transformers, each consisting of three 15,000-kva., single-phase, 25-cycle, 118,000 to 65,000 to 13,200-volt oil-insulated, self-cooling, three-winding outdoor transformers and one spare, have been installed. Condensers rated at 25,000 kva., 500 r.p.m. are being manufactured and will be connected one to each 45,000 kva. of the transformer bank. These are unusual in that they are of the vertical outdoor type with thrust bearing below the rotor and the exciter direct connected below the thrust bearing. They will be equipped with the quick response excitation and automatic starting equipment with remote control. These machines are required to control the 13,200 volts under varying load conditions and in conjunction with the underload changers on the 110-kv. windings of the transformers and give flexibility to the distribution of the reactive kilovolt-amperes between the 220- and 110-kv. systems, besides increasing the efficiency of the systems by making it possible to operate near unity power factor when desirable.—*Electrical News (Canada)*, May 15, 1929.

Units, Measurements and Instruments

Investigation of Electric Impulses with the Cathode-Ray Oscillograph.—W. KRUG.—The use of a Dufour oscillograph to investigate the fronts of traveling waves in symmetrical impulse connections on long and on short lines indicate that under certain conditions oscillations do not occur as an aperiodic transition. The cause of these oscillations, which may have considerable effect upon the front itself, was found to be the mutual capacity between the impulse condensers. Further investigations showed that even for extremely short lines the impulse voltage may have superimposed oscillations, which may be damped out by suitable resistances, either in the line itself or across the tested object. Many oscillograms are illustrated, explaining this phenomenon. The writer also indicates a new connection for exceedingly fast deflection of the sweeping light beam, which permits catching phenomena within ten to the minus-ninth-power second, excellently suited for the recording of timely uncontrollable transients. — *Elektrotechnische Zeitschrift*, May 9, 1929.

Motors and Control

Double-Slot Induction Motor.—D. H. LUND.—In European countries where there are severe restrictions in the use of squirrel cage armature induction motors, the Boucherot type double-slot motor continues to gain ground. Comparing the plain induction motor with the wound rotor motor, three important factors must be considered: starting current, power factor and starting torque. A four-pole induction motor requires 2.4 times, a wound rotor motor only 1.6 times running current, or 50 per cent less. At the same time most of the 1.6 times over current is in-phase, while the larger part of the 2.4 over current is wattless. Finally, the plain induction motor gives only up to 50 per cent starting torque. The double-slot induction motor remedies all these disadvantages and is, in fact, superior to the wound rotor. A number of European concerns are now manufacturing these motors, some of them further improving their characteristics by the use of star-delta starters and a simple but positive centrifugal clutch, built into the motor pulley.—*Elektrotechnik und Maschinenbau*, May 5, 1929.

Illumination

Ultra-Violet Light from Incandescent Lamps.—H. KOCH.—The stimulating effect of natural sunlight, due to its component of ultra-violet light waves, made it desirable to develop an artificial illuminant of about the same effect. The most wdely used type of such a lamp is the mercury-arc quartz tube, but its spectrum is of the line type and the amount of ultra-violet light is proportionally much larger than that of sunlight. A proper dosing for medical purposes is therefore difficult. A better and safer way was found in the performance of the recently marketed so-called Uviol glass bulb incandescent lamp, which gives a continuous spectrum down to 280 μ ultra-violet. With a glass wall of ½ mm. thickness, 65 per cent of the available ultra-violet light is emitted. The trade name of these new lamps is "Vitalux."—*Elektrotechnik und Maschinenbau*, May 5, 1929.

Electrophysics, Electrochemistry and Batteries

Dielectric Strength.—M. C. TIMMS.—According to the author the time factor associated with the dielectric strength of solid materials has not received the recognition which its importance merits and the discussion which is offered represents an endeavor to establish a more rational attitude toward this element. The experimental work which has been done has been limited to the impregnated paper insulation of high-voltage cables. Equations are offered, as are methods of testing, customary treatment of results, revised treatment as suggested by the author, cable life, and conclusions derived as a result of this investigation. It is stated that the first conclusion to be drawn from the phenomena discussed is that any mention of breakdown voltage without at the same time referring to duration of stress is really meaning-

less. It is also stated that any one voltage and time are not sufficient to specify in order to determine the dielectric strength of a material, at least three points being required to disclose the shape of a curve. The second conclusion is that the useful life of a sound cable can be only very slightly affected by repeated transient voltages of the greatest magnitude likely to be experienced. At the same time instantaneous breakdowns by surges can be regarded as impossible and routine double voltage tests may be repeated as often as found necessary without deleterious effects. It is the author's contention that no cable has ever failed in service due to maximum stress alone, and it is certain that, provided proper care is taken of field distribution, greater working stresses than those hitherto customary may be safely used.—*Electrical Engineer (Australia)*, May 15, 1929.

Heat Applications and Material Handling

Immersion Water Heaters.—R. H. RAWLL.—Practical results obtained by the author in connection with the use of immersion water heaters in a domestic hot water system have been outlined and the possibilities for automatic thermostatic control developed. In this particular instance the electric heating has been applied to an existing coal-fired hot water system in such a way that either method of heating may be put into commission separately or jointly at will, and this, it is said, has been accomplished at comparatively small cost and with minimum inconvenience. The performance data and characteristic curves for the particular installation described have been included. The information consists largely of experience data with a single installation.—*Electrical Review (England)*, May 31, 1929.

Traction

Research on Mercury-Arc Rectifiers.—J. V. ISSENDORFF.—Many successful investigations have been made in the past to improve the vacuum-technical, mechanical and electrode detail of mercury-arc rectifiers, the practical application of which resulted in the design of reliable and fairly large units of both the glass and metal type. Occasional backfire is the only phenomenon not fully conquered and perhaps not fully understood and led to more research of the current transportation between electrodes. A contribution to such knowledge is presented in this discussion, in which tests on glass bulb rectifiers made with the aid of a combination of electrical measurements and high-speed photographs are described. The author demonstrates that properly arranged protective surfaces give the rectifier a longer life and allow more than double the output. The result is that today units of more than tenfold the capacity can be built than was possible only three years ago. Rectifiers of 25,000 amp. at 800 volts are in successful operation.—*Elektrotechnik und Maschinenbau*, April 28, 1929.

Miscellaneous

Electrical Pressboards.—A. R. DUNTON and A. W. MUIR.—The development of electrical pressboards constitutes, according to the authors, a remarkable if not unique example of a material rising in a few years from the status of a third-rate insulator to that of one suitable for the most important applications in the manufacture of high-voltage apparatus. In spite of this the subject has received little attention in articles and publications dealing with insulating materials, and it is said that the majority of engineers have overlooked the improvements which have been effected in the characteristics of this material. Several grades of pressboard are available and not only are the various classes described but their uses and dielectric characteristics pointed out. It is stated that the best electrical boards are produced from specially selected and blended fibers, the raw material being treated by boiling, cleaning and straining processes similar to those in paper making so as to form a highly hydrated cellulose pulp. The manufacturing processes, as well as the application of this material, are described. Transformers as high as 500 kva. for test work and 66 kv. for substation installation are mentioned as utilizing this material.—*Electrician (England)*, May 10, 1929.

Book Reviews

Recent Economic Changes in the United States

Report of the Committee on Recent Economic Changes of the President's Conference on Unemployment. New York: McGraw-Hill Book Company, Inc. Two volumes, 950 pages.

A comprehensive analysis of post-war developments in American economic life by a group of eminently qualified experts on the various branches of business and industry. The study includes the reports of a special staff of the National Bureau of Economic Research, Inc. This report follows upon a similar study of cycles and unemployment made in 1922-23 and a study of seasonal operation in the construction industries made in 1923-24.

Proceedings International Congress on Illumination, 1928

Chemical Publishing Company, Easton, Pa. 1,458 pages. Applications for copies should be made to the Illuminating Engineering Society, 29 West 39th Street, New York, N. Y. Price, $10.

This volume includes the proceedings of the seventh plenary session of the International Commission on Illumination, held at Saranac Inn, N. Y., September, 1928, and also selected papers presented at the twenty-third annual convention of the Illuminating Engineering Society. Theme subjects treated at length are: Street lighting, glare research, motor vehicle headlighting, distribution of luminous flux, precision photometry and standards, heterochromatic photometry, natural lighting, decorative lighting, vocabulary, definitions and symbols, school and factory lighting, illumination research, colored signal glasses, diffusing materials, motion-picture lighting, the I.C.I. tour, general sessions reports and the results of an international survey on show-window lighting, home lighting, lighting education and aviation lighting practice. In all the volume contains sixty-nine papers and reports by authors recognized as the leaders in illumination throughout the world. Many specialized applications are surveyed and studied in the volume.

The vast amount of authoritative information contained in the proceedings will prove an invaluable reference source to those who wish to continue research along these lines and also to illuminating engineers whose daily activities bring them into close touch with many problems in lighting practice. The volume is indexed and cross-indexed as to contents and personnel and is profusely illustrated.

Book Note

A SUMMARY OF ENGINEERING RESEARCH AT THE LAND-GRANT COLLEGES AND UNIVERSITIES, 1929. Published by the Engineering Experiment Station Committee of the Association of Land-Grant Colleges and Universities, Manhattan, Kan.

A list of engineering experiment station bulletins and of researches in progress has been published by the Engineering Experiment Station Committee, Association of Land-Grant Colleges and Universities, of which Dean Milo S. Ketchum of the University of Illinois is chairman and Professor R. A. Seaton is secretary. The summary shows that there are 38 stations, to only seven of which funds have been appopriated by state legislatures, totaling $153,990; $527,403 has been allotted by the institutions and $758,625 is available from other sources. There are 278 full-time, 392 part-time paid and 255 part-time employees without extra pay; 1,263 bulletins and circulars have been published. Projects in electrical engineering research are included.

Book Received

"Radio, Telegraphy and Telephony." By Rudolph L. Duncan and Charles E. Drew. New York: John Wiley & Sons, Inc. 950 pages, illustrated. Price $7.50.

News of the Industry

Seattle Council Indorses Bond-Issue Ordinance

City Fathers Pass Measure Calling for $13,500,000 to Carry Out Five-Year Development Program—Ross Wants City to Buy Puget Sound Company

PROVISION for a five-year development program for the Light Department of Seattle is made in an ordinance authorizing a bond issue of $13,500,000 passed very recently by the City Council. All the features of the plan for enlarged facilities on the Skagit River, inside the city, and at Cedar Falls on the Cedar River are included. The building of a new power house at Diablo, to have a maximum rating of 120,000 hp. and cost about $2,500,000, is one of the important parts of the work, which was briefly described in the ELECTRICAL WORLD for April 20 (page 799).

Acquisition by the city of Seattle of the holdings of the Puget Sound Power & Light Company within the city was last week recommended to the City Council by J. D. Ross, superintendent of the city light system. Mr. Ross urged that the private company holdings be taken over by condemnation proceedings as a means of eliminating duplication of service within Seattle. The city light rate could be cut in half if the program was carried out, according to Mr. Ross.

Honor Paid to H. C. Couch

More than four hundred business men, representing several states, paid tribute to Harvey C. Couch of Pine Bluff, Ark., president of the Arkansas Power & Light Company and of associated companies in Louisiana and Mississippi, at a testimonial banquet held at Little Rock on June 25. The principal address was made by John C. Lonsdale, president of the Mercantile Bank & Trust Company, St. Louis, who said that Mr. Couch had done more for the advancement of Arkansas, Louisiana and Mississippi through water power and electrical development than any other individual in his time or before him.

Many tributes by letter and telegram were received. President Hoover joined in these tributes, saying: "I am very happy to join with the other friends of Harvey C. Couch in the testimonial that his neighbors are tendering him. I have known Mr. Couch for the public-spirited citizen that he is. I am sure that the people of Arkansas will always remember the great constructive work that he did during the disastrous flood of 1927. I extend my compliments to Mr. Couch and my congratulations to his neighbors who thus do him honor."

S. Z. Mitchell of the Electric Bond & Share Company, said of Mr. Couch: "He dreams dreams that always come true. I regard him as the most practical constructive genius that the South and West have ever produced. He is practical because his plans are sound, and he always knows how to get the money

H. C. Couch

to put them through. He is so human that nobody can know him without loving him. I am proud to be associated with him."

Other messages and letters were from Charles S. McCain, president of the National Park Bank of New York; L. W. Baldwin, president of the Missouri Pacific Lines; Governor Huey P. Long of Louisiana and capitalists, industrialists and other nationally known business executives.

Proposed New High-Tension Line in East Ohio

A preliminary survey for the Penn-Ohio Edison Company of a high-tension transmission line to run from the Ohio River Edison Company's generating station at Toronto, in east Ohio, northwestwardly to Akron, about 75 miles, is to be made by Stevens & Wood, with estimate of cost. This line, if it should be decided to build it, will form an interconnection with the Northern Ohio Power & Light properties of the Penn-Ohio in the city last named. No further details of the undertaking are yet in shape for publication, those appearing in various newspapers being unauthenticated and incorrect.

American Standards Association Directors Meet

Reorganization of Body Under Industrial Control Is Completed—Membership in International Standards Association Under Consideration

UTILITY and railroad presidents and other first-line executives representing nine of the nation's chief industries met on Tuesday, July 9, at the headquarters of the American Standards Association in New York and took over the direction of the national standardization movement. The American Standards Association has 38 member bodies, including six departments of the federal government and "the Panama Canal." James A. Farrell, president of the United States Steel Corporation, has since 1925 been chairman of the advisory committee, and he made the following announcement in connection with this organization meeting of the first board of directors of the association as now constituted:

"The full control of national standardization policies since the organization of the American Standards Association as the American Engineering Standards Committee in 1919 has been entirely in the hands of engineers and scientists. The reorganization which led to the formation of the board resulted from the increasing interest of industrial executives in national standardization work. The first meeting of the board is expected to be followed by an intensive campaign to finance national standardization activities on a larger scale than heretofore."

The board of directors now includes Matthew S. Sloan, president of the New York Edison and affiliated electric companies; L. A. Downs, president of the Illinois Central Railroad; Bancroft Gherardi, vice-president of the American Telephone & Telegraph Company; F. E. Moskovics, president of the Improved Products Corporation; Quincy Bent, vice-president of the Bethlehem Steel Company; Howard Coonley, president of the Walworth Company; R. J. Sullivan, vice-president of the Travelers Insurance Company; C. L. Collens, president of the Reliance Electric & Engineering Company, and George K. Burgess, director of the United States Bureau of Standards.

One of the most important of the questions that came up on Tuesday was that of American participation in international standardization activities. The International Standards Association, an affiliation consisting of the national standardizing bodies of Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Holland (with reservation), Hungary, Italy, Norway, Russia, Sweden and Switzerland, had

formally invited the American Standards Association to its membership, and this invitation awaited the action of the board of directors, which, however, decided to postpone action on the invitation until the next meeting. The International Standards Association now maintains an office at Baden, Switzerland.

Canada Gets Proposal for New Power Scheme

The Canadian government has received a new proposal for a gigantic canal and lock project on the St. Lawrence. The scheme, as outlined in a letter to the Minister of Public Works from Henry Timmis of Montreal, is based upon power revenues and would involve a projected canal in three sections, two in Ontario and one in Quebec. Mr. Timmis says that he is acting on behalf of a group of Canadian and American investment banking houses and of three large American concerns that contemplate establishing industries in Canada. Under the proposal the present 22 locks would be replaced by five, and the company would give the waterways to Canada without any charge or expense and free from any bonded indebtedness.

If they receive encouragement from the Dominion government, the promoters propose to apply for incorporation as the "St. Lawrence Waterways & Power Company." They also intend to offer the Ontario Hydro-Electric Power Commission one-half of the power and the other half would be used for new industries or sold to existing power distributors in the Province of Quebec.

In the Legislative Mills

MISSOURI.—Governor Caufield has vetoed the terminable-permit bill passed by the recent session of the Legislature. The bill was sponsored by the St. Louis Transportation Survey Commission in its rapid-transit program. The Governor's conclusion was that the measure invaded the city's charter rights, notwithstanding its support by all city officials. The bill affected only transportation companies and only the city of St. Louis.

New York Attorney-General's Power Merger Report

Newspaper stories purporting to forecast the contents of the report which Attorney-General Hamilton Ward of New York is to render to Governor Roosevelt next Monday on the Niagara-Hudson Power Corporation merger did not come from him, the Attorney-General told an ELECTRICAL WORLD correspondent. These stories said that the Attorney-General would recommend that the Public Service Commission receive regulatory powers over holding corporations operating in the state. What Governor Roosevelt asked from the Attorney-General, however, was specific information as to whether a monopoly had been created by the merger in violation of the provisions of the general business and stock corporation laws.

D., L. & W. Electrification

Associated Gas & Electric System Makes Long-Term Contract to Supply Power for Railroad's Electrified Lines in New Jersey

A LONG-TERM contract has been entered into by the Associated Gas & Electric system to supply the Delaware, Lackawanna & Western Railroad with power for a portion of its lines which are to be electrified. Service for the initial step of the electrification will be furnished from the West Wharton substation of the Associated system, where double-circuit steel-tower transmission lines operated at 110,000 volts are brought in from the Pennsylvania-New Jersey power system of the Associated Gas & Electric Company.

The Lackawanna has undertaken the electrification of a part of the Morris & Essex division extending from Hoboken to Dover via Morristown, the Montclair branch from Roseville Avenue station to Montclair, the Passaic & Delaware branch from Summit to Gladstone and that part of the Boonton line extending from Bergen Junction to Kingsland. The railroad may in the future also electrify the cut-off from Harrison to Kingsland, the Morris & Essex division from Dover to Port Morris and the Boonton line from Kingsland to Denville.

Between 6,000,000 kw.-hr. and 10,000,000 kw.-hr. annually will, it is estimated, be delivered at the outset by the Associated system to the railroad's substations, to be located at Denville and Bernardsville, N. J., to meet its initial requirements from this source. An extension of the Lackawanna's electrification through to Port Morris will largely increase, it is expected, the demand for power from the Associated system in New Jersey as the Lackawanna's main line runs through Associated territory.

The steam generating station which is now under construction for the Associated system at Holland, N. J., is expected to be placed in operation next November. Its initial installation will be about 55,000 kw., and the plant will be connected with other generating stations in the Pennsylvania-New Jersey power unit of the Associated system by 110-kv. transmission lines. Through this tie-up a large amount of electrical energy will be made available to the Lackawanna Railroad and other customers of the Associated system.

Provisions of the electrification contract made by the Lackawanna with the Public Service Electric & Gas Company were printed in the ELECTRICAL WORLD last week (page 30).

Michigan Association Elects New Officers

At the closing session of its annual convention at Mackinac Island, July 3 (see last week's ELECTRICAL WORLD, page 29), the Michigan Electric Light Association chose the following officers for the coming year: President, E. L. Edwards, Lapeer, vice-president and general manager Michigan Electric Power Company; first vice-president, D. W. Hayes, Port Huron, district agent Detroit Edison Company; second vice-president, D. E. Karn, Kalamazoo, district manager Consumers Power Company; secretary-treasurer, Herbert Silvester, Ann Arbor (re-elected).

Preliminary investigations into the possibilities of storage-type water heaters, arranged for off-peak operation by means of a time switch and separate meter, were described by R. R. Clark of the Consumers Power Company, Jackson. He expressed the belief that this type of water heater offers enormous possibilities, solving the problems of electric water heating and poor load-factor conditions and that, equipped for off-peak operation, a more substantial profit can be realized at 1 cent to 1½ cents per kilowatt-hour off-peak than at 2 cents for energy available 24 hours a day.

J. C. Langdell, Allied Power & Light Corporation, Jackson, described various types of meters and meter housings for outdoor use on summer residences and other buildings to which access might be difficult. W. A. Wadsworth, Ludington, vice-president and general manager Michigan Public Service Company, and A. S. Albright, Detroit Edison Company, presented discussions.

E. M. Burd, of Stevens & Wood, Jackson, in a paper on "Comparative Costs of Generating Electricity by Water Power and by Steam," said that "the relative expense of developing small water powers and tying them in with the up-to-date utility transmission system is so disproportionate to their output as to render them valueless or worse—a liability." Phelps Vogelsang, forester of the State Highway Department, commended the efforts of most utilities to trim trees carefully and asked for continued co-operation.

Index Published Separately

THE index of the January to June, 1929, issues of the ELECTRICAL WORLD will be published as a separate pamphlet with elaborate cross references. If you bind your copies attach this notice to a sheet of paper, sign it with your name, company position and address and mail it to the Circulation Department, McGraw-Hill Publishing Company, Inc., Tenth Avenue at 36th Street, New York City, and an index will be sent to you.

Problems of High-Tension Systems

Thirty-two Nations Are Represented at Fifth Biennial Conference at Paris—Thorough Treatment of Wide Range of Topics—Contributions from United States

DELEGATES representing 32 nations assembled in Paris last month for the fifth biennial International Conference on Large Electric High-Tension Systems. The chief contributions from United States engineers were Dr. C. O. Mailloux's second report on the rational utilization of fuels, A. O. Austin's paper on the latest researches in high-tension laboratories, a paper on the breakdown of air gaps at very high voltages by J. J. Torok and Dr. J. Slepian, one on 2,000,000-volt impulse testing by D. J. Miner and H. W. Tenney, and one on high-tension outdoor substation design, with lantern slides and motion pictures, by H. W. Young and Alfred Alsaker.

The conference lasted for nine days, 108 papers being presented. Some of these were of a mathematical or purely descriptive character which did not conduce to active discussion. Others concerned what Theodore Rich, a British delegate, on whose full report in the London *Electrician* these notes are partly based, calls "burning topical issues."

The president of the conference, M. Ulrich, speaking on the opening day, described its object as being the interchange of information and the free discussion of matters of technical interest between government, municipal, consulting and manufacturing engineers, and also educators and others interested in the problems surrounding the operation of high-tension systems.

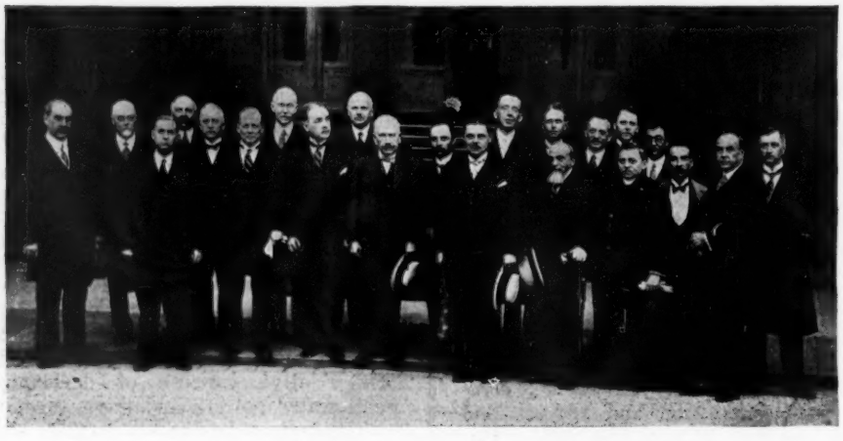
Technical proceedings began on the second day, June 7, when the discussions related to fuel, steam turbines, alternators, parallel operation and switchgear. Dr. Mailloux's paper was presented on this day. It dealt in the main with conditions in the United States, stressing the increased capacity of steam-raising plant per unit of space due to the almost instantaneous combustion obtained with pulverizers. French, Dutch and Swiss delegates followed with papers on high-pressure and high-temperature steam turbines, the insulation of slots and end coils, the evolution of alternators and automatic starting and paralleling from a distance.

A paper by J. Reznicek dealt with exchanges of energy between stations operating in parallel. The Swiss committee reported on oil switches, dwelling on the desirability of finding a common ground by which switchgear can be compared and rated. Motion pictures and films were displayed showing the operations of switch-testing stations and the effect of short circuits on section links and busbar supports. E. B. Wedmore of Great Britain discussed the economical design of commercial circuit breakers, and Dr. Whitney, also from England, alluded to the behavior of arcs under various voltages.

The first day was typical of those that followed. A wide range of subjects was treated with the thoroughness and attention to detail characteristic of European engineers. Papers on power production covered such topics as the study of alteration and testing of transformer oils, testing of insulating materials other than oils, a proposed set of international rules for quality marks, the design and testing of oil switches, calculation of large-capacity transformers, a study of the uses of insulating material, influence of magnetic field on the dielectric strength of materials and losses, and dielectric losses in transformer oils.

The construction and insulation of lines brought out a general report on technical specifications to be applied to the supply and testing of high-tension cables, besides papers on a new cable and its qualities, the influence of atmospheric conditions on insulator performance, wooden construction for high-tension lines, and the interrupting capacity of oil switches and a new quenched-arc switch. Under "networks operation" were grouped treatises on a uniform type of international statistics of power production and distribution, power-factor improvements, parallel operation, neutral earthing, induction regulator used as power-factor regulator for interconnection of power stations, lightning and surge propagation in high-tension lines, selective protection of transmission lines, investigation and statistics on system surges, interconnection of different frequency systems, operation of large interconnected systems, investigation and measurements on 132,000-volt lines, and long-distance signaling in electric systems.

Several of the papers were the work of Russian engineers. Finland and Czechoslovakia were also represented among the contributors.



Heads of Delegations to International High-Tension Conference at Paris

Left to right: (1) C. Budeanu, Roumania; (2) Nordberg-Schulz, Norway; (3) U. del Buono, Italy; (4) S. Mateeso, Roumania; (5) T. Thrige, Denmark; (6) H. W. Young, U. S. A.; (7) R. Borlase-Matthews, England; (8) Tribot-Laspière, France; (9) K. Drewnowski, Poland; (10) C. O. Mailloux, U. S. A.; (11) M. Ronvaux, Belgium; (12) M. Ulrich, France; (13) P. V. Hunter, England; (14) E. Gevaert, Belgium; (15) J. R. Beard, England; (16) J. Tomanek, Czechoslovakia; (17) E. Wilczek, Hungary; (18) S. Malmfors, Sweden; (19) K. Mori, Japan; (20) Abdel Aziz Bey Ahmed, Egypt; (21) F. Brock, Austria; (22) K. Stromberg, Finland.

A.S.T.M. Holds Meeting at Atlantic City

At the annual meeting of the American Society for Testing Materials, held at Atlantic City last week, F. E. Bash and J. W. Harsh presented a paper on "Life Tests on Metallic Resistor Materials for Electrical Heating" which outlined the history of life tests and described experiments carried out by committee B-4, of which Dean Harvey was chairman. This committee reported cooperative test work on elastic properties of alloys at 500 to 1,000 deg. C.; also investigations on temperature coefficient and thermal emf. of electrical resistance alloys. It presented results of tests on effect of size of wire on density and resistivity and described new accelerated life test for electrical resistance alloys.

Committee D-9, on electrical insulating materials (H. S. Vassar, chairman), reported progress on studies of insulating varnishes, molded and sheet insulating materials and liquid insulation and recommended revision of the test for resistivity of insulating materials to make it applicable to solid and liquid materials. It also recommended revision of the standard methods of testing molded insulating materials and presented revisions of four additional tentative standards.

Committee B-1, on copper wire (J. A. Capp, chairman), recommended for adoption as standard the tentative specifications for bronze trolley wire and reported progress in the study of specifications for wire and cable for transmission lines, and co-operation with the N.E.M.A. and the American Mining Congress in the development of standards for grooved trolley wire.

T. D. Lynch, Westinghouse Electric & Manufacturing Company, will be the new president and F. O. Clements, General Motors Corporation, Detroit, the new vice-president.

Jefferson City No Longer to Be Electrically Isolated

A construction project of major importance to Jefferson City, Mo., and to the districts composing the central power group of the Missouri Power & Light Company — Mexico, Moberly, Boonville, Brookfield and Kirksville— is the 66,000-volt, double-circuit, three-phase A.C.S.R. steel-tower transmission line under way between the Missouri capital and Mexico. It involves two new substations, one just west of Jefferson City and the other south of the "waterworks" property of the company at Mexico. In addition, the capacity of the Jefferson City plant is to be increased by the installation of two new 500-hp. boilers fired with pulverized coal. The new line will cross the Missouri River at Jefferson City with a 2,000-ft. span. Three hundred steel towers are to be erected, 600 ft. to 1,500 ft. apart, depending upon the elevation of the land.

Heretofore the system at Jefferson City has been completely isolated from other power sources. With the completion of the new line the Jefferson City plant will feed into the central Missouri power pool. Should an emergency occur which necessitated shutting down the Jefferson City plant, the city would receive its electricity from the pool, the chief power sources of which are the plants at Boonville, Mexico and Keokuk, Iowa.

Rural Service in Nebraska

The Nebraska Power Company took on as customers during 1928 106 farmers along transmission lines already in service at an average cost per customer of $260. This included those farmers who could be served from a transformer in place and also extensions as much as five spans distant from the line. The company built, in addition, to eighty-six farms farther away to serve groups at an average cost of $600. The company's experience is that to reach farmers in eastern Nebraska, where the average is about two and a half to the mile and where rural population is densest, the cost cannot be cut below $650 per customer. Construction costs in 1928 were $1,000 per mile, using 30 ft., 7-in. poles with spans of 160 ft. to 175 ft., and with a meter pole in the farmyard with a 3-kva. transformer, a one-span installation cost $253.

This year the company is using a substitute for copper wire, increasing span length and cutting cost to $850 per mile. It is expected that this will assist in the development of long lines by reducing expense to the farmer from $75 to $50. Superintendent MacKinnon says that costs cannot be materially lowered, since if cheaper construction is used the lines won't stand up, and if smaller capacities, longer secondaries and cheaper metering equipment are used, heavy-duty appliances cannot be served.

Rates in Nebraska are $3.50 and upward for service charge, with 7 cents for the first 30 to 50 kw.-hr. per month, the excess being about 4 cents. This brings an average return of $70 a year —not sufficient revenue for extensions of more than 800 ft. or 900 ft. The Nebraska company is trying out the guaranteed annual revenue plan, and these patrons average 102 kw.-hr. per month and pay an average of $120 a year, where the non-guarantee customers, all those within five spans of an already existing line, average 38 kw.-hr. per month and $70 a year. The company is rapidly purchasing privately owned extensions where a flat rate of 15 cents with $2 monthly minimum bill has long existed, with the result of increasing gross income by an average of 50 per cent.

Purchases and Mergers

Many Widely Scattered Transactions—Jersey Central Power & Light Now Has Chatham Plant—New England Power and Attleboro Rival Suitors for Local Company

SALE of the municipal electric system of Chatham, N. J., to the Jersey Central Power & Light Company has been consummated, the price being $285,600. A protest lodged with the Borough Council says that the Council campaigned for the sale of the plant, which was decided at the primaries, and that the sum received was little more than half its value.

The New England Power Company has offered the equivalent of about $130 a share for stock of the Attleboro (Mass.) Steam & Electric Company, reports from Boston say. The Attleboro company is one of the last of the independent electric companies in New England. The City Council has passed a motion favoring the acquisition of the plant by the city.

The Vestal (N. Y.) Lighting Company has made application to the Public Service Commission for approval of its acquisition by the New York State Electric Corporation. The petition states that the Binghamton Light, Heat & Power Company now serves Vestal Township and is to apply for approval of the transfer of its franchises, works and systems to the New York State Electric Corporation.

At a hearing before the New York Public Service Commission on the petition of the Antwerp Light & Power Company for consent to transfer to the St. Lawrence County Utilities Company its system and franchises in Antwerp, Philadelphia and Theresa no objections were offered.

Control of virtually all the water rights on the Lake Keuka (N. Y.) outlet, pivot of the proposed Lamoka double-fall power project, have passed into the hands of John T. Andrews & Company, former subsidiary of the E. L. Phillips interests and now associated with the Associated Gas & Electric Company. The property consists of two major parcels, one including the Lake Keuka outlet from Main Street, Penn Yan, upward to Lake Keuka, and the second the property and water rights through a flume beneath the mills downstream.

The Long Island Capital Corporation, a New York State holding company, has petitioned the Public Service Commission to allow it to acquire not less than 1,600,000 or all of the 3,000,000 outstanding common shares of the Long Island Lighting Company so that it may become the financial adviser of the latter company.

The Borough Council of Emporium, Pa., has turned over to the West Penn Power Company for $250,000 the municipal light and power plant together with a franchise. The company will erect a substation on the outskirts of the town and its high-tension line will augment the supply of the acquired plant.

Fourteen manufacturing companies of Beaver and Butler Counties, Pa., have filed with the Public Service Commission a protest against the proposed merger of the Pennsylvania Power Company, Harmony Electric Company and People's Power Company as the Pennsylvania Power Company. The protesting companies are customers of the Harmony Electric Company.

Cyrus S. Eaton of Cleveland, head of large steel interests, is reported to have acquired working control of the United Light & Power Company as the result, it is said, of the surrender of part of the holdings of the Koppers-Mellon interests in this Middle West utility, which has assets of more than $500,000,000 and controls operating companies in Indiana, Iowa and other states.

Mayor Thomas of Columbus, Ohio, recently received a letter from Fred L. Eubeler & Company, Chicago, making three alternative offers for the municipal light plant. All were refused.

The Midland Utilities Company has absorbed control of the Union City Electric Company, which operates in both Union City, Ind., and Union City, Ohio, through purchase of common stock from the National Electric Power Company.

The Missouri Public Service Commission has been asked to approve the sale of the Mokane Electric Light & Power Company to the Citizens' Electric Company of Missouri and to grant the latter a certificate for the operation of the Mokane plant. The price agreed upon is $21,000 cash.

Because of notice from a power company which seeks to purchase the Pierre (S. D.) electric light plant that it proposed to have the plant sold by legal petition under the 1929 law, the City Commission rescinded its action in which a vote on the matter of sale was set for July 9.

The Alabama Power Company would acquire electric distribution systems in ten additional Alabama towns under the terms of a proposal submitted to the Public Service Commission by the power company and the Alabama Water Service Company. Should the application be granted, all electric plants owned by the water service company would pass into the hands of the power company and all water plants owned by the Consumers' Water Company, purchased from the power company, would be transferred to the Alabama Water Service Company. Under the contract the Alabama Power Company would acquire electric plants which now serve Fort Payne, Valley Head, Crossville, Collinsville, Portersville, Center, Leesburg, Dawson, Greensboro and Newburn.

An offer of $135,000 from the Georgia Power Company for the electrical distribution system of Jonesboro, Ga., has been

accepted by the City Council. The power company will take over the system on or about August 1.

The Missouri-Arkansas Power & Light Company has bought the power plant of the Handy (Ark.) Power & Light & Ice Company.

A heated fight is expected at Jonesboro, Ark., on July 25, when three vacancies for the city's Board of Commissioners, in control of the municipal electric plant, will be filled. The fight will be waged over the issue of whether or not to sell the plant.

Citizens of Granbury, Tex., will vote on a proposal to sell the municipally owned electric lighting and power plant to the Texas Power & Light Company.

The municipally owned electric light and water plant of Runge, Tex., was sold by vote of the citizens to the Central Power & Light Company on June 27. The vote was 183 to 76.

Regardless of the fact that the voters of Burlington, Colo., sanctioned selling its municipal electric power plant to the Inland Utility Company of Denver in the June election, some citizens are seeking to prevent the sale by court injunction. The Inland's price is $175,000, and unless the court acts against the voters' decision, transfer of the property will follow.

Halford Erickson, vice-president Byllesby Engineering & Management Corporation, announces the purchase of the properties of the Northwest Power Company at Thermopolis and Buffalo, Wyo., and the conclusion of negotiations whereby the properties of the Lander (Wyo.) Electric Light & Power Company also are acquired.

In pursuance of a recently announced policy of buying all available water-power sites in Ontario when the prices to be paid are justified by the earning capacity, the Ontario Hydro-Electric Power Commission has acquired from the M. J. O'Brien Company, Ltd., the Claybank, Stewartville, Burnstown and High Falls power sites in the Ottawa Valley at a cost of $1,800,000. These plants have an aggregate capacity of approximately 85,000 hp., and negotiations for their purchase have extended over a period of two years. The assets acquired by the commission also include two existing developments known as the Calabogie and Galetta plants, which generate about 6,000 hp. and are now serving several districts in eastern Ontario. The properties purchased are situated on the Madawaska and Mississippi Rivers, both tributary to the Ottawa River.

Salt Springs Dam Is Taking Definite Shape

Salt Springs Dam, a vital link in the thirty-million-dollar Mokelumne River (Calif.) hydro-electric development of the Pacific Gas & Electric Company, is taking definite shape. Work is complete on 250 ft. of concrete cut-off wall, 6 ft. thick, built into bedrock at the upstream base of the dam. A 1,200-ft. tunnel, 19 ft. in diameter, through which water impounded by the dam will flow into the first of four power houses, has also been completed.

Three hundred and thirty feet high, 1,300 ft. wide at the crest and 900 ft. through at the base, the Salt Springs Dam will create a reservoir 4 miles long, with a storage capacity of 130,000 acre-ft. of water. Passing through the first of the power houses at the downstream base of the dam, this water, together with water diverted from Bear Creek and Cold Creek, nearby tributaries, will develop 42,000 hp. of electrical energy and will then be carried through 20 miles of concrete canal to another power plant at Tiger Creek with a capacity of 80,000 hp. Thence it will be conveyed 20 miles through canals to the Tabeaud power house and to increase the output of the Electra power house, after which it will return to the regular course of the Mokelumn. Two more years will be required to complete the project.

San Francisco Executives Condemn Valuations

In announcing their dissent from the valuations arrived at by the California Railroad Commission for their San Francisco systems, which the city is seeking to condemn (ELECTRICAL WORLD, June 22, page 1298), President A. F. Hockenbeamer of the Pacific Gas & Electric Company and Vice-President A. Emory Wishon of the Great Western Power Company made clear their determination to fight the commission's decision. Mr. Hockenbeamer said:

Our San Francisco plant is part of a regional system which for many years has been dedicated to the service of other cities and territory as well as to San Francisco. We believe it is contrary to the Constitution of the United States to seek to transfer to any one city facilities so dedicated and essential to good service and equitable rates over a widespread territory.

Important elements of damage have not been fully considered. The allowance for severance damage alone is millions less than we claim and far below what we believe the courts will ultimately allow.

The figure of $26,685,000 does not, in our opinion, cover the mere physical value. Neither does it attempt to cover $13,000,000 of new property which we have added since the condemnation proceedings were filed in 1924.

If the total—$26,685,000, plus $13,000,000 for additions, approximately $40,000,000 in all—should be taken as a basis for a bond election, I can't conceive of the people voting that amount in bonds to transfer the electric service of San Francisco from private to political operation and management. So far as ownership is concerned, the property is now publicly owned. It is the property of 53,000 stockholders, 20,000 of whom live in San Francisco.

Mr. Wishon's statement follows:

The decision was a distinct surprise to the officials of the company. The commission's findings of the amounts of compensation to be paid for the electric properties in San Francisco and for severance damage to the remaining properties in the event that the San Francisco properties are taken by the city are many millions of dollars less than we expected the commission would award.

This proceeding has been pending for five years and four months. The findings of value and damages are fixed as of February 11, 1924. In the meantime the company has expended on its San Francisco electric properties upward of $4,500,000, and it will spend much more before the properties could ever be taken over.

The company intends to exercise every legal remedy under the constitution of California and of the federal government.

Quebec Adopts Uniform Rules for Domestic Service

Unifom rules governing the supply of electricity and gas by utility companies to the public for lighting, heating, cooking and the operation of domestic appliances have been formulated and adopted by the Quebec Public Service Commission and will become effective throughout the province on September 1 next.

The code, the first of its kind Quebec has had, is based on a draft prepared by technicians of the commission, modified by the commissioners in the light of evidence submitted by writing and at a public hearing held in Montreal some time ago. Three features emerge from the set of rules: (1) A standard and very simple form of contract between suppliers and consumers will replace the various forms now in use, some of them complicated and containing legal reservations. (2) The consumer will not be obliged to bind himself for normal service for longer than one year; in cases where electricity rate benefits accrue from longer-term contracts, the differential will not exceed 0.5 cent net per kilowatt-hour. (3) Service deposits will bear interest at 4 per cent per annum, payable at the office of the supplier at the end of each calendar year, or, if not claimed by the consumer, payment will be made at the end of every five years by check or credit note.

Cheap Power and Rural Service in Quebec Province

Some idea of the industrial activity that now characterizes the Lake St. John region of Quebec may be gleaned from the statement that 2,000 tons of paper are produced every 24 hours, together with some 80 tons of aluminum ingots. The latter industry is now using 100,000 hp. generated at Arvida, and plans are to build the plant up to five times this size.

Addressing the Ottawa branch of the Engineering Institute of Canada recently on the water powers of this region, J. E. A. Dubuc, member of the federal Parliament, made the statement that the late Sir Adam Beck's dream of distributing power to entire rural communities was being realized sooner in Quebec than in Ontario. He said that in another year all farms in the two counties of Chicoutimi and Lake St. John will be served with electricity.

Mr. Dubuc asserted that energy from the Saguenay was the lowest-cost power in Canada, $75 per horsepower representing the capital cost of installation at Isle Maligne and $60 the cost at Chute-à-Caron. Three hundred thousand horsepower on the Peribonka River can be developed at the same or lower cost, he added, pointing out that power at the stations is sold as low as $9 and $10 per horsepower in the Saguenay district.

Briefer News

JAMESTOWN, N. Y., TO ENLARGE MUNICIPAL PLANT.—Jamestown, N. Y., is to build a brick and steel addition to the municipal lighting plant at a cost of $125,000. It is planned to install a 12,500-kw. turbo-generator in the addition, with auxiliary equipment.

EDISON STAMP GOES INTO SECOND EDITION.—The Postmaster-General will issue an additional quantity of 110,000,000 of the special Edison postage stamp which marks the fiftieth anniversary of the incandescent lamp. The unprecedented demand for this "Light's Golden Jubilee" issue has already sold almost the entire 180,000,000 first issued.

AUGUSTA (GA.) CITY DAM TO BE RAISED.—Application of the city of Augusta, Ga., to raise the crest of the city dam across the Savannah River eighteen inches has been approved by Secretary of War Good. This will mean an increase in hydro-electric power for use in Augusta and the surrounding section.

ELECTRICITY WILL HELP THE PRESIDENT TO FISH.—A. H. Cave, president of the Madison Power Company, and T. H. Amiss of Culpeper, Va., have begun securing right-of-way for a power line to connect the Madison system with that of the Page Power Company, in order to have additional energy available for the presidential fishing camp on the Rapidan River. The Madison company has recently completed a line to the fishing camp.

NEW BEDFORD RATES GO DOWN.—The New Bedford (Mass.) Gas & Edison Light Company has announced a reduction in electric lighting rates. A sliding scale will provide lower rates for 85 per cent of the residential customers and 88 per cent of other than residential consumers. The base rate for residential and non-residential consumers is 8 cents per kilowatt-hour. Residential customers will pay 5 cents after the first 15 kw.-hr. and 2½ cents after 65 kw.-hr. Non-residential users will pay 8 cents for the first 10 kw.-hr., 7 cents for the next 50 kw.-hr., 5 cents for next 60 kw.-hr. and then 2½ cents.

THREE NORTH DAKOTA COMPANIES REVISE RATES.—Revised electric rate schedules proposed by the Northern States Power Company and applicable at Minot, Berthold, Burlington, Des Lacs and Lone Tree, N. D., have been approved by the State Railroad Board. Revised rates filed by the Red River Power Company and applicable at Grand Forks, Buxton, Hatton, Larimore, Portland, Reynolds, Thompson, Emerado, Arvilla and Cummings also have been approved, as have revised rates filed by the Union Light, Heat & Power Company and applicable at Fargo and in Fargo Township. The two companies last named are Northern States Power subsidiaries.

TEACHERS' FEDERATION DENOUNCES "POWER TRUST."—Meeting at Chicago last week, the American Federation of Teachers adopted resolutions denouncing the "power trust," which it accused of seeking to use the public schools to spread propaganda against public ownership of utilities. Speakers attacked the "insidious efforts" of the National Electric Light Association and other agencies in "subsidizing professors."

DEVELOPMENT PLANS OF HOLYOKE WATER POWER COMPANY.—The Holyoke (Mass.) Water Power Company has authorized the construction of a hydro-electric station on land at the second-level canal near Appleton Street, to utilize water now going over the No. 2 overflow. The unit will have a capacity of 3,500 kw., the same as the unit at Whiting No. 2 mill. This project, estimated to cost $500,000, is expected to take precedence over the construction of the unit at No. 4 overflow at Cabot Street, recently scheduled for early development.

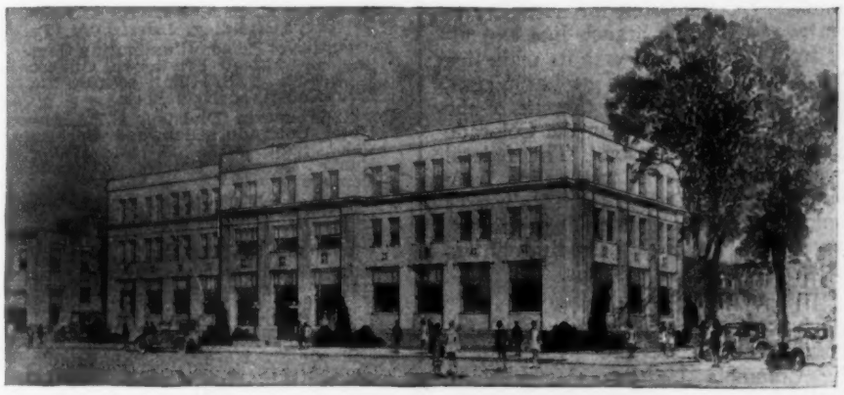
DECISION ON BALTIMORE RATES EXPECTED SOON.—A decision by the Maryland Public Service Commission in the rate case affecting the Consolidated Gas, Electric Light & Power Company of Baltimore is expected late this month. The principal feature of the case, which was heard during the last three weeks of June, was a demand by Thomas J. Tingley, people's counsel, that a cut of at least $1,000,000 be made for small consumers. On the other hand, the industrial consumers' association demanded that they share in any reduction ordered. Members of the commission let it be understood that a cut would be ordered, but whether or not the industrial consumers would benefit they would not say. The company denied that its present charges are too high and held that the rate of return was well within the restrictions placed by the commission upon public utilities.

DATE FOR CALIFORNIA RATE HEARINGS SET.—The California Railroad Commission has ordered a formal investigation into the electric rates of the Pacific Gas & Electric Company and the Great Western Power Company, the former hearing being set for August 27 and the latter for August 29. This action follows the hearing on June 4 when both companies contended that the rates were not unreasonable and urged that this was not a proper time for investigation.

MOSHER FALLS (N. Y.) HYDRO PLANT COMPLETED.—The newest hydro-electric plant of the Northern New York Utilities, the 12,000-hp. Mosher Falls development on the upper reaches of the Beaver River, has been completed and became part of that system on July 10. The Mosher Falls development, which contains two 6,000-hp. generating units as initial equipment, has a 216-ft. head. The penstock is 2 miles long and 10½ ft. in diameter. Building the dam and appurtenances has taken about a year.

PHILADELPHIA & READING COAL & IRON COMPANY TO BUILD GENERATING PLANT?—According to an analysis of the Philadelphia & Reading Coal & Iron Company made by Hirsch, Lilienthal & Company, the mining company contemplates erecting an electric generating plant at Herndon, on the Susquehanna River, near Sunbury, Pa., where it will burn anthracite coaldust from its collieries, thus paralleling the mouth-of-mine plants erected by interests connected with the Lehigh Coal & Navigation Company. A generating plant in

Appalachian Company's Coming Charleston Building



AMONG the architecturally attractive office buildings planned by light and power companies in various cities is that which the Appalachian Electric Power Company will erect for its district offices at Charleston, W. Va. As the architect's drawing shows, it is in contrast with the skyscraper type, being built on latitudinal rather than longitudinal lines. It is designed for five stories and will be 165 ft. x 60 ft. in area, with modern layout and lighting features.

the neighborhood of Sunbury has been talked about as a coming event for the last six or seven years, a site at Selinsgrove being said to have been purchased by prominent promoters of electric light and power.

ENGINEERING REPORT INDORSES SANDSTONE FALLS DAM IN WEST VIRGINIA.—Late in June an engineer's report on the proposed construction of a dam at Sandstone Falls, New River, by the New-Kanawha Power Company was submitted to the Public Service Commission by J. K. Anderson. His report says that the dam and embankment would be safe, economically sound and adequate for the protection of the Chesapeake & Ohio Railroad.

ELECTRIFICATION OF WEST SIDE TRACKS IN NEW YORK. — The New York Central Railroad has obtained an extension of time until January 1, 1931, to complete the electrification of its West Side freight line between Seventy-second Street and Spuyten Duyvil, New York City, under an order of the Public Service Commission. This work is essentially a part of the elimination of grade crossings, and the extension of time will enable the two objects to be carried out together.

WISCONSIN POWER & LIGHT OCCUPIES NEW OFFICES.—Offices filling the seventh, eighth and ninth floors and parts of the sixth and tenth floors in its new ten-story building at Madison, Wis., are now occupied by the Wisconsin Power & Light Company as headquarters, the company's bus station and offices being on the ground floor. The building, surfaced in Indiana limestone and terra cotta and with its interior in marble finish, is in the heart of the business district and an addition to the city's architecture.

TO BUILD RAILROAD TO BOULDER DAM SITE.—An application has been made by the Los Angeles & Salt Lake Railroad Company to the Interstate Commerce Commission for authority to construct a 23-mile branch line extending from a connection with its main line at a point 7 miles south of Las Vegas, Nev., eastwardly toward the site of the proposed Boulder Dam on the Colorado River at Black Canyon. The federal government will construct a line from the terminus of the Salt Lake Railroad's branch line to the Boulder Dam project. The branch line will pass through no incorporated cities or towns.

OREGON COMPANY RECOGNIZES OBLIGATION NOT TO INVADE TERRITORY.—The Columbia Utilities Company of Portland, Ore., has filed a formal request with the state regulatory department asking that an application made recently for a certificate of convenience and necessity to operate in the town of Bly be withdrawn and the matter removed from the commission docket. The commission entered an order in compliance with the request. The Columbia Utilities Company is the owner and operator of the Vernonia Light & Power Company, a property located in the county adjoining the city of Portland. The recalled application for an operating certificate covered territory situated in southern Oregon and directly within the recognized field of the California-Oregon Power Company of Medford.

FUNDS TOO SMALL FOR COMPREHENSIVE WATER SURVEY IN NEBRASKA.—A special commission recently named by Governor Weaver of Nebraska has decided, after a preliminary survey, that the $25,000 appropriated by the Legislature will not permit of a comprehensive examination of the possibilities of Nebraska waters for beneficial power and irrigation uses. The commission therefore will take up only special matters that will not duplicate any of the work now being done in the Platte Valley by government engineers in connection with flood control of the Missouri and Mississippi Rivers.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

Wisconsin Utilities Association—Electric Section, Wausau, July 18-19. J. N. Cadby, 432 Broadway, Milwaukee.

Camp Co-operation IX — Association Island, Henderson Harbor, N. Y., Aug. 2-6. Society for Electrical Development, 600 Graybar Bldg., 420 Lexington Ave., New York.

International Association of Municipal Electricians—Statler Hotel, Boston, Aug. 20-24. H. N. Lang, box 1864, Orlando, Fla.

International Association of Electrical Inspectors, Western Section — Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Santa Monica, Calif., Sept. 3-6. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4-6. H. A. Buch, Telegraph Building, Harrisburg, Pa.

Association of Edison Illuminating Companies—Chateau Frontenac, Quebec, Sept. 9-12. P. S. Millar, 80th St. and East End Ave., New York.

Rocky Mountain Division, N.E.L.A.—Hotel Colorado, Glenwood Springs, Colo., Sept. 9-11. O. A. Weller, Public Service Co. of Colorado, Denver.

New England Division, N.E.L.A. — Hotel Griswold, New London, Conn., Sept. 9-12. Miss O. A. Bursiel, 20 Providence St., Boston.

Empire State Gas and Electric Association—Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society — Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

American Electric Railway Association —Atlantic City, Sept. 28-30. J. W. Welsh, 292 Madison Ave., New York.

Association of Electragists International—New Ocean House, Swampscott, Mass., Sept. 30-Oct. 3. L. W. Davis, 420 Lexington Ave., New York.

FRUEAUFF SERVICE STATION OPENED IN DENVER.—The Public Service Company of Colorado has just opened a large new service station in Denver named in honor of the late F. W. Frueauff, long prominent in the Doherty organization. The building houses the electrical and gas service and engineering departments and meter shops, garage accommodations, warehouses, an assembly hall and a first-aid hospital. Five hundred employees work in and from the two buildings included in the station.

TWO IOWA MUNICIPALITIES STICK TO PRIVATE SERVICE. — Clarksville (Iowa) voters at a special election have authorized renewal of the 25-year franchise of the Iowa Public Service Company by a vote of two and a half to one. The franchise application was rejected eighteen months ago by a small majority.——By a vote of two to one, citizens of Albia (Iowa) have rejected the plan of the Municipal Utilities Company of Des Moines to establish an electric power plant to supplant the Albia Railway & Light Company, subsidiary of the Iowa Southern Utilities Company.

OFFICERS FOR INDIANAPOLIS UTILITIES DEPARTMENT.—Henry L. Dithmer of Indianapolis, a well-known business man, has been elected president of the board of directors of the Indianapolis Utilities Department, provided by act of the Legislature to manage any utility properties that may be taken over by the city under a municipal ownership plan. John J. Madden was named vice-president, Guy A. Wainwright secretary and Almus G. Ruddel treasurer. Brodhurst Elsey, Edward A. Kahn and Eli Lilly, the other members of the board, were named as a committee to write bylaws and rules.

TULSA - FAYETTEVILLE INTERSTATE LINE HAS REACHED COMPLETION.—Another important interstate power connection has been accomplished with the completion of the 97-mile, 66,000 volt transmission line between the generating plant of the Southwestern Gas & Electric Company at Fayetteville, Ark., and the Tulsa plant of the Public Service Company of Oklahoma. (ELECTRICAL WORLD, May 4, page 898.) The new line adds 3,000 kw. to the available power in the Fayetteville territory. Actual interconnection was made at Forest Park, a point on the Arkansas-Oklahoma state line just north of Westville, Okla.

FIRST UNIT OF SHUSWAP RIVER, BRITISH COLUMBIA, STARTS UP.—The first 3,800-hp. unit of the Shuswap Falls power development on the Shuswap River in British Columbia went into

service recently when Premier Tolmie pressed the button which formally dedicated the development to the domestic and industrial requirements of the Okanagan Valley. This initial development represents only a small proportion of the power available on the Shuswap. Under the water rights held by R. E. Wilsey & Company, Chicago, a maximum output of 20,000 hp. is indicated.

COUNTED-ROOM RATE SPREADS IN UPSTATE NEW YORK.—The Utica Gas & Electric Company has filed with the New York Public Service Commission a new and lower rate for residential electric service in Little Falls. The same rate has recently been filed for Amsterdam, Gloversville and Johnstown by the New York Power & Light Corporation. It is 25 cents per month per counted room, with a minimum of three counted rooms, plus an energy charge of 5½ cents per kilowatt-hour for the first ten hours per counted room and 3 cents for all additional electricity used.

GEORGIA POWER COMPANY'S NEW SUBSTATIONS. — The Georgia Power Company has put in operation a new substation at Marietta and begun the construction of a fourth high-tension switching and transforming unit in Atlanta. The latter will be known as the Northwest substation and will be built at Hall Place and Willie Street, about half-way between the Boulevard and East Point substations. It will be put in service about November 1. With its completion the company will have four substations arranged in a ring about the city which will step down the power coming in at 110,000 volts to 19,000 volts for transmission.

NEW INDUSTRIAL RATES PROPOSED FOR DALLAS, TEX.—The Dallas (Tex.) Power & Light Company has applied to the city for permission to effect a marked reduction in the rate charged for electrical energy to industrial users in the desire to help in a campaign now under way to bring new industries to Dallas. The company proposes two new optional rates. The more important will apply to consumers using the company's single-phase alternating current who contract for not less than 15 kw. maximum demand, and this new rate will effect a reduction of approximately $150,000 a year in their bills.

ILLINOIS COMPANIES AGREE UPON TERRITORIAL BOUNDARY LINE. — Recently both the Central Illinois Public Service Company and the Illinois Power Company, both having headquarters at Springfield, filed petitions with the Illinois Commerce Commission for permission to furnish service in the vicinity of Berlin and between Salisbury and Farmingdale. The former company withdrew its petition and the territory went to the Illinois Power Company. Now both companies have again petitioned to serve the same territories, those of Buckhart and Berry and Breckenridge. Though no hearing has been held and no order written by the commission, the companies have negotiated a settlement by the terms of which the east line of Sangamon County will be the dividing line of their respective territories.

DAYTON-SPRINGFIELD LINE IN OHIO TO BE PUSHED.—The interconnection to be made between the systems of the Dayton Power & Light Company and the Ohio Edison Company, already reported in the ELECTRICAL WORLD, is to be at 66,000 volts. Right-of-way has been obtained, construction work is beginning and the line will be pushed rapidly to completion. As the Dayton company is already connected to the Columbia station, 20 miles from Cincinnati, the new line will make exchange of energy possible from the Ohio River to Springfield, a distance of 85 miles. The Dayton Power & Light and Ohio Edison have no corporate affiliations.

Recent Court Decisions

NEGLIGENCE MUST BE ESTABLISHED, NOT PREDICATED ON INJURY.—Blisters on the inside of the index finger and ball of thumb of the right hand of a boy found dead in a basement where he had been sent to attend to a furnace were held by the Court of Appeals of Kentucky to be insufficient evidence that he had been killed by shock while trying to turn on the electric light (Spencer's Administrator vs. Number Four Superior Coal Company). The plaintiff alleged that a 2,300-volt wire had come into contact with the low-voltage wire serving the lamp. This the court held unproved, observing that it was incumbent upon the plaintiff to establish the negligence as well as the injury. (16 S.W. [2d] 168.)*

ISSUE OF NEGLIGENCE AND THE JURY—EXPERT TESTIMONY.—In Yarn vs. Fort Dodge, Des Moines & Southern Railroad Company, the United States Circuit Court of Appeals held that whether installation by defendant's workmen of a transformer with high-voltage uninsulated wires in close proximity to the stub end of a steam pipe was negligence and the proximate cause of injury to the plaintiff, who was injured when electric wires came into contact with the pipe as he sought to remove the latter, was a question of fact for the jury, as was the question of contributory negligence. A directed verdict for the defendant was therefore reversed. The federal court also sustained the contention that an expert may testify whether, in his opinion, a particular installation shown by evidence is safe or proper, and such opinion may be tested on cross-examination by reference to other authorities and supported on redirect examination in the same way. (31 Fed. [2d] 717.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

CLASSIFICATION OF RATES PERMITTED.—The Public Utilities Commission of Colorado has ruled that a utility company may make a "reasonable classification of rates" and under special circumstances may make discounts to a customer. This ruling was the outcome of a request from the Public Service Company of Colorado for permission to make a special rate for power to the smelter at Leadville and the Deep Mines Company in that city. It was related that the Deep Mines Company had spent over a period of two years $460,000 for the purpose of unwatering its mines, electrically driven pumps being used, and that they must be kept going if the mines were to be worked. Other mining companies protested on the ground of discrimination, but the commission held that a reduction from ordinary mining rates was justified under the particular circumstances of this case.

MAINE COMMISSION FORBIDS MERGER OF LOCAL UTILITIES WITH A HOLDING COMPANY.—Ruling that the proposed consolidation of fifteen water service utilities would be "detrimental to public interest," the Maine Public Utilities Commission has refused to permit the merger of the group with a corporation known as the Maine State Water & Electric Companies. In its decision the commission says: "We cannot see any sound economic reason to support the plan proposed by the petitioners and believe that its operation would not be beneficial to the public interest but instead would be detrimental thereto." The decision explains that it was brought out at hearings that the Maine State Water & Electric Companies is a holding company and that "it was shown that this company neither owned nor operated any company engaged in any public utility business."

POLICY OF REFUSING NEW CONTRACTS FOR DIRECT CURRENT SUSTAINED. — The complaint of Shroder & Koppel, Inc., of New York City against the New York Edison Company, alleging refusal to furnish direct current for power, has been dismissed by the Public Service Commission. The firm applied for direct current for its elevators, but the company declined to furnish anything but alternating current. The complainants said that it would cost $17,000 to install an elevator that would operate on alternating current. The New York Edison Company avowed its policy to restrict the use of direct current, so far as possible, to those localities where it is now supplied and to substitute alternating current where possible. The company will furnish direct current until existing contracts are fulfilled. To carry out its policy it must cease taking on new direct-current business. In this instance it was shown that the complainant had not prepared plans for elevator equipment but was awaiting a decision upon the complaint. The commission said: "The company is not charged with a refusal to furnish electric service, but to render a certain kind of service. In view of the fact that the policy of the company to substitute alternating current for direct current is well known to the commission and is not disputed as a measure of good business policy, and that no discrimination was being practiced against the complainant in this instance, the complaint should be dismissed."

News About Men of the Industry

Stuart Wilder Appointed to Vice-Presidency

Stuart Wilder has been appointed a vice-president of the Westchester Lighting Company, according to an announcement made by Eugene H. Rosenquest, the president. Mr. Wilder, who is widely known in the public utility industry, has served since February, 1928, as vice-president of the Bronx Gas & Electric Company, of which Mr. Rosenquest is also the administrative head. He was graduated from Swarthmore College in 1894 and for several years thereafter was engaged in the lumber industry in Tennessee. About 1901 he entered the employ of the Stanley Electric Manufacturing Company in Pittsfield, Mass., and later became affiliated with Sanderson & Porter, engineers, of New York City.

Mr. Wilder in 1903 entered the employ of the Westchester Lighting Company as assistant chief engineer of the electric department. In 1905 he was made vice-president and general manager of the Northern Westchester Lighting Company and during the following year also became vice-president and general manager of the Peekskill Lighting & Railroad Company. In 1912 he was appointed chief electrical engineer of the Westchester Lighting Company, retaining the executive offices with the two other utility organizations. In 1919 Mr. Wilder resigned these three positions to engage in another field of endeavor. His great interest in public utility service caused him to return to the gas and electric industry, however, and in 1922 he went with the Bronx Gas & Electric Company in the capacity of electrical engineer. In December, 1924, he was appointed general superintendent and electrical engineer and early in 1928 was promoted to the vice-presidency. He is a member of the American Institute of Electrical Engineers, the American Gas Association and a former president of the Empire State Gas and Electric Association.

YASUZAEMON MATSUNAGA, president of the Toho Electric Power Company, Ltd., sailed from Vancouver on the *Empress of France* after a two months' visit in Europe and America. During his stay in America Mr. Matsunaga inspected the great power projects in the United States and Canada.

LEE H. MCCRAY, formerly general manager of the northwest region of the Pennsylvania Electric Company, with headquarters at Erie, Pa., has been appointed general manager of the Erie Lighting Company, succeeding H. G. Thuerk, who has been transferred to the New York office of the Associated Gas & Electric Company.

LEAVITT L. EDGAR, a vice-president of the Edison Electric Illuminating Company of Boston, Mass., since 1926, has been elected a director of the company, succeeding the late Oliver Ames. Mr. Edgar joined the operating bureau of the company in 1910 and in 1918 was appointed assistant general superintendent.

PERCIVAL MOORE has assumed the general managership of the Kentucky Electric Development Company with headquarters in Louisville. Mr. Moore constructed and operated the first electric interurban railway between Louisville and Shelbyville and La Grange, Ky. He engaged in mining in northern Ontario for several years, and since that time has been connected with banking organizations as consulting engineer on mergers and corporate financing. He was educated at the Worcester Polytechnic Institute and following graduation he engaged in the manufacture of electro-therapeutical apparatus in Louisville.

L. S. Leavitt to Manage Lowell Company

Louis S. Leavitt has been appointed manager of the Lowell (Mass.) Electric Light Corporation, succeeding L. E. Seekins, who recently was transferred to the managership of the Worcester (Mass.) Electric Light Company by the New England Power Association. Mr. Leavitt was born at Yerington, Nev., in 1888 and was graduated from the University of Nevada in 1910 from the school of mechanical and electrical engineering. His early professional career included service with the Sierra Pacific Electric Company, General Electric Company and Stone & Webster, Inc. In 1915 he was on the Lowell company's staff and a year later became electrical engineer of the Tin Mines of Siam Company, spending three years in the Orient. On returning to the United States he was employed for two years by the Bucyrus Company, South Milwaukee, Wis., rejoining the Lowell Company in 1922 as electrical engineer and later becoming superintendent of distribution. For the past two years he has been managing editor of *Electric Light and Power.*

Schoellkopf Vice-President of New Company

Alfred H. Schoellkopf, vice-president and general manager of the Buffalo, Niagara & Eastern Power Corporation, has been named a vice-president of the Niagara Hudson Power Corporation, recently formed to acquire the Buffalo, Niagara & Eastern Power Corporation, the Northeastern Power Corporation and the Mohawk-Hudson Power Corporation. Before the Buffalo, Niagara & Eastern Power Corporation was formed Mr. Schoellkopf was vice-president and general manager of the Niagara Falls Power Company. At the present time he is a member of the executive committee of the board of directors of the Buffalo, Niagara & Eastern Power Corporation, the Niagara Falls Power Company the Buffalo General Electric Company, the Niagara, Lockport & Ontario Power Company and the Niagara Junction Railway Company and a director of the Niagara Electric Service Corporation and the Tonowanda Power Company. Mr. Schoellkopf is the son of the late C. P. Hugo Schoellkopf and received his education at the Phillips Academy at Andover, Mass., and at the Massachusetts Institute of Technology.

J. A. SPENCER has been appointed superintendent of the Southern Sierras Power Company, Manhattan, Nev., succeeding H. H. Walker, resigned.

DAVID W. BEAMAN has been appointed manager of the Edison Gas & Electric Light Company, New Bedford, Mass., following several months' service as acting manager in place of W. H. Snow. Mr. Beaman was formerly general superintendent of the company and is widely known in New England central-station circles.

GEORGE B. THOMAS, formerly secretary and treasurer of the Utah Power & Light Company, Salt Lake City, Utah, has been elected vice-president and secretary of that company. Mr. Thomas has had long experience in the public utility field. He was auditor of the Telluride Power Company, prior to the organization of the Utah Power & Light Company, and was made auditor and assistant treasurer of the latter company in 1912, later becoming secretary and treasurer. He is also secretary and treasurer of the Utah Light & Traction Company and the Western Colorado Power Company, Durango.

T. T. Parker Heads North Central Division of N.E.L.A.

Thomas T. Parker, president and general manager of the Northwestern Public Service Company, Huron, S. D., has been elected president of the north central division of the National Electric Light Association at the recent annual meeting. Mr. Parker's public utility career began in the spring of 1913, when he became commercial manager at Parsons, Kan., for what is now the Kansas Electric Power Company, which property was then owned by Albert Emanuel Company. Later for a period of two years he served as manager of the Union City (Ind.) Electric Company and subsequently as manager of the Emporia division of the Kansas Electric Power Company. Early in 1923 he removed to Dubuque to assume the duties of vice-president and general manager of the Dubuque Electric Company and following this connection he was appointed vice-president and general manager of the Kansas Electric Power Company. It was in 1927 that Mr. Parker became affiliated with the Northwestern Public Service Company in the capacity of vice-president and general manager, advancing to the presidency and general managership in 1928. With this background of managerial experience with the electric utilities in that section, Mr. Parker is unusually well qualified to head the local division of the National Electric Light Association.

A. V. Bennett, vice-president of the West Penn Electric Company, West Penn Power Company and subsidiary companies, has retired from active business. Mr. Bennett has been associated with the West Penn and its parent company, the American Water Works & Electric Company, Inc., for fifteen years. In May, 1928, he was elected vice-president of the West Penn Power Company and in June of the same year vice-president of the West Penn Electric Company.

Charles Gordon, editor of the *Electric Railway Journal*, a McGraw-Hill publication, has been selected by the advisory council of the American Electric Railway Association for appointment to the office of managing director of that body to succeed Lucius S. Storrs. His appointment is subject to confirmation by the executive committee of the association. It is expected that he will assume the duties of his new position September 1.

K. T. Folkenson, construction superintendent of trasmission lines for the Broad River Power Company, with headquarters in Columbia, S. C., has been transferred by the Associated Gas & Electric Company to the New Jersey Power & Light Company, another subsidiary of its system. Mr. Folkenson has been connected with the Broad River Power Company for the past five years. He will have temporary headquarters in Dover, N. J.

Arthur Huntington, public relations engineer of the Iowa Railway & Light Corporation, Cedar Rapids, Iowa, has been elected first vice-president of the American Society of Agricultural Engineers.

Samuel Insull, Jr., president of the Midland Utilities Company, Chicago, and an officer of other utility properties in the Middle West, arrived in New York aboard the White Star liner *Majestic* after making a short visit to Europe.

W. E. Wickenden President Case School

William E. Wickenden, the new president of the Case School of Applied Science, is nationally known as an educator. He received his education at Denison University and at the University of Wisconsin and he taught at the latter institution for two years following graduation. In 1909 he became assistant professor of electrical engineering at the Massachusetts Institute of Technology and from 1914 to 1918 he was associate professor in the same department. In 1917 he made a study of educational and personnel problems for the engineering department of the Western Electric Company, which led to the creation of a personnel department of which he became manager in 1918. Later be became chairman of the Western Electric Company's personnel committee. In 1921 he was transferred to the headquarters staff of the American Telephone & Telegraph Company, as assistant vice-president in charge of the recruiting and development of supervisory and technical personnel for the group of companies making up the Bell System. This work included the promotion of relations with universities and colleges throughout the country. During the past few years he has been director of investigation for the Society for the Promotion of Engineering Education.

In the course of his career Mr. Wickenden has not been without practical engineering experience, his early work having been of that nature, with special emphasis on illuminating engineering. He has written quite extensively on this subject, on power plant engineering and personnel problems in industry. Mr. Wickenden has been active in the American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education.

Obituary

William Baurhyte

William Baurhyte, formerly president of the Los Angeles Gas & Electric Corporation, died July 4 at his home in Los Angeles following a heart attack. Mr. Baurhyte retired from active duty with this corporation March 31, 1928, and since that time had been resting. His service with the Los Angeles Gas & Electric Corporation dated from September 1, 1903, when he was named as second vice-president. At that time he was employed by the Pacific Gas Improvement Company. He rose to the position of vice-president and general manager and served in this capacity until 1924, when he was elected president of the corporation. Mr. Baurhyte began his business career in San Francisco as a law clerk 55 years ago. Ten years later he entered public utility affairs and from that time until his retirement he devoted his business life to that industry.

John J. O'Connell, assistant hydraulic engineer of the Electric Bond & Share Company, died of heart failure in Rio de Janeiro, Brazil, July 4. He was serving temporarily in Brazil as chief hydraulic engineer for the Emprezas Electricas Brasileiras, S. A. Mr. O'Connell's career had been intimately related with the development of the engineering department of the Electric Bond & Share Company. After two years of mining engineering, he was employed by an associated company of Electric Bond & Share Company in July, 1910, in the development of a water-power project on the Pacific Coast. In June, 1912, he was transferred to the engineering department in New York and since that time he had been active in the design of many hydro-electric projects in the United States and abroad and in the investigation and development of the hydro-electric possibilities available for the companies associated with the Electric Bond & Share Company. Since the termination of the World War, his activities had been principally in Central and South American countries in connection with subsidiaries of American & Foreign Power Company, Inc.

Charles A. Learned, for many years manager of the Meriden (Conn.) Electric Light Company and one of the best known among the older central-station executives in New England, died at his home in Meriden June 25. Mr. Learned was born in Watertown, Mass., in 1863. His early career included service with the Newton & Watertown Gas Light Company and the United Gas Illuminating Company in New Jersey. In 1896 he went to Meriden as general superintendent, later becoming manager. He was made manager of the Meriden district of the Connecticut Light & Power Company upon the recent acquisition of the Meriden company by that organization.

Banking Group Forms New Light and Power Alignment

Bonbright-Morgan-Drexel Banking Group Forms Important Utility Mergers in Eastern United States—Details of Organization and Financing

NEW and important alignments are being formed in the power and light field these days. New holding companies are being launched and new cross-currents of ownership and control are being set up under the sponsorship of a group of the nation's leading bankers. There has now developed what is virtually a secondary merger movement. It is a major merger movement, confidently expected but indefinitely foreseen as to form, and is apparently urged on by major financial considerations as well as operating reasons. It supplements the earlier consolidation movement through which the individual operating companies were originally thrown, largely for interconnection and diversity purposes, into holding company groups.

The properties involved in this newest merger movement are in the eastern half of the United States and serve some of the most important areas in New York, Pennsylvania and New Jersey, in Michigan and Ohio and in Tennessee, Alabama and Georgia.

In point of time the first intimation of the new trend was the launching of the United Corporation at the beginning of the current year by banking interests headed by the Morgan-Drexel-Bonbright group. The initial acquisitions of the United Corporation included certain minority holdings in the United Gas Improvement Company, Public Service Corporation of New Jersey and Mohawk-Hudson Power Corporation, then held by the banking group itself and by the American Superpower Corporation. It issued 3,810,863 no-par common shares and nearly a million $3 cumulative preferred shares. The stock was not issued publicly, but was offered on an exchange basis to holders of the stocks named. The United Corporation later acquired a minority interest in the Allied Power & Light Corporation, which was an earlier consolidation of the Hodenpyl, Hardy and Stevens & Wood interests.

The Commonwealth & Southern Corporation Appears

The second stage in the new merger process was the formation of the Commonwealth & Southern Corporation by interests headed by Bonbright & Company, Inc. Announcement was initially made that this corporation would acquire 40 per cent of the stock of the Commonwealth Power Corporation, Southeastern Power & Light Company and Penn-Ohio Edison Company. The response on the part of shareholders, however, was apparently unusually satisfactory and it was not long before the new corporation acquired a considerable majority of the stock of the three constituent companies on an exchange basis for its own stock.

As in the case of the United Corporation, the formation of the Commonwealth & Southern Corporation involved no public offering of securities, but was carried out on an exchange basis. The authorized capitalization is represented by 2,000,000 shares of preferred stock and 60,000,000 shares of no-par common stock. There has already been sold to large utility corporations approximately 2,500,000 shares of common stock with warrants attached. The principal purchasers were the American Superpower Corporation, Electric Bond & Share Company and the United Corporation, each of which acquired 500,000 shares, and also Allied Power & Light Corporation, which holds 250,000 shares. Assuming that a substantial majority of stockholders exercise the privilege of exchange, the new corporation will have assets in excess of $700,000,000.

Up-State New York Companies Merge

Following soon upon the announcement of the Commonwealth & Southern Corporation there was launched a new holding company to institute a long-negotiated merger of upper New York State utilities, including Buffalo, Niagara & Eastern, Mohawk-Hudson and Northeastern Power. This new corporation, called the Niagara Hudson Power Corporation, was sponsored by J. P. Morgan & Company. There was no initial offering of stock to the public. An exchange basis was arranged between the stocks of the constituent companies and that of the new corporation. Niagara Hudson Power Corporation issued 2,000,000 shares of common stock and also option warrants to purchase common stock.

Executive and directorate inter-relations between the various holding units are evident from a glance at the slate of directors and officers. George H. Howard, formerly of Simpson, Thacher & Bartlett, who was chosen to be president of the United Corporation, is common to all three. Bonbright & Company is represented on the board of the Niagara Hudson Power Corporation by George Roberts and on the United Corporation and Commonwealth & Southern by Alfred L. Loomis and Landon K. Thorne. The Morgan and Drexel interests are represented on the United Corporation by Thomas F. Gates and George Whitney and on the Niagara Hudson Power Corporation by Harold Stanley. The Electric Bond & Share Company is represented on the Commonwealth & Southern board by Sidney Z. Mitchell and C. E. Groesbeck. Ray P. Stevens is president of Niagara Hudson Power and a director of Commonwealth & Southern, having resigned as president of Allied Power & Light. B. C. Cobb is chairman of the board of the Commonwealth & Southern and also of Allied Power & Light and a director of Mohawk-Hudson.

Holding Companies Involved in New-Type Mergers

The United Corporation holds minority interests in:

United Gas Improvement Company
Public Service Corporation of New Jersey
Niagara Hudson Power Corporation
Commonwealth & Southern Corporation
Allied Power & Light Corporation (of Delaware)
Columbia Gas & Electric Corporation
and minor miscellaneous investments

The Commonwealth & Southern Corporation owns controlling interests in:

Commonwealth Power Corporation
Southeastern Power & Light Company
Penn-Ohio Edison Company
and has recently made an offer for
Columbus Electric & Power Company

The American Superpower Corporation (of Delaware) holds minority interests in:

Commonwealth & Southern Corporation
United Corporation
Niagara Hudson Power Corporation

as well as

Electric Bond & Share Company
National Power & Light Company
United Gas Improvement Company
Italian Superpower Corporation
United Illuminating Company
United Light & Power Company
Electric Light & Power Corporation
American Gas & Electric Company
Cities Service Company
American & Foreign Power Company, Inc.
Consolidated Gas, Electric Light & Power Company of Baltimore
American Power & Light Company
Detroit Edison Company
etc.

Allied Power & Light Corporation owns minority interests in:

Commonwealth & Southern Corporation
American Superpower Corporation
Niagara Hudson Power Corporation
and full control of
Stevens & Wood, Inc.

The United Gas Improvement Company holds minority interests in:

Public Service Corporation of New Jersey
Niagara Hudson Power Corporation
Commonwealth & Southern Corporation

The ultimate significance of the consolidation process thus briefly outlined cannot yet be fully appraised. From a geographic viewpoint the utility map of the eastern half of the United States has been rearranged. Control has been further centralized to a marked degree. Properties worth well in excess of a billion dollars have changed hands, in so far as control is concerned, or, more properly speaking, have been unified as to control by the formation of new partnerships. Superficially, what has happened is merely an extension of that movement which has tied America's utilities into mutually helpful and economically sound and justifiable groups. The distinction is not without significance, however, that the initiators of the current movement, and those in whose hands now lies the ultimate control, are essentially a banking group, supported, of course, by executives experienced in the utility field.

What is the public value of such a merging process? It must be admitted that any current merging movement in the power and light field will inevitably involve a diminishing ratio of advantage to the operating companies and their consumers—at least from an economic standpoint. Furthermore, the enormous appreciation in the value of the securities of constituent companies, amounting to probably more than half a billion dollars, indicates a heavy discounting of future possibilities.

Looking at the other side of the picture, it is apparent that the earlier merger movement left a large number of holding companies, each bordering one or more others, without any definite arrangement for interchange of power, logical development of the territory or co-operation in other respects. For example, a consideration of the power areas in Tennessee, Alabama and Georgia with the economic use of water, fuel and load possibilities leads to the consideration that the Tennessee, Alabama and Georgia major operating properties could be developed most advantageously under the holding company direction of a single corporate entity. Thus the owners of the separate groups sat around the table and, on a partnership basis with a proportionate exchange of securities, carried out this project under the auspices of the Commonwealth & Southern Corporation. Again, it may be presumed that Niagara and St. Lawrence power developments and power sales would come about more economically and to the greater benefit of the utilities and their customers if a similar corporate entity was formed. Otherwise two or three separate groups would make separate and different plans and create an element of delay and disorganization advantageous to no one. Thus the Niagara Hudson Power Corporation unifies industry interests in a major regional development. In a similar way a study may be made of the New York, New Jersey and eastern Pennsylvania power area, whereby the future destiny of the region might well be produced most economically and quickly under the auspices of a single corporate entity. But how far this idea can be carried without involving complexities and magnitudes beyond the ability of a single organization to handle no one can say at present. The present partnership or pooled interest mergers are merely indicative of a trend that has promising possibilities.

It may be assumed that tangible economies will be had in investments and in administration, but beyond this there will be provided a unity in thought and act that should develop the power possibilities of a territory most expeditiously and most economically. The overhead costs should be reduced, the financing costs decreased and the operating ratio improved, and good management will share all these savings with consumers and improve the service to consumers. There is little doubt that the new merger movement will swing to other regions and will mark a new stage of development in the utility industry.

IOWA'S TRANSMISSION LINES AND PLANTS. — Twelve thousand miles of line, classified according to voltage from 66,000 to 2,200 volts, are shown on a map of Iowa electric power stations and transmission lines prepared for the State University of Iowa Power and Industrial Conference and dated May, 1929. Distinguishing symbols are used for steam, hydro and oil stations, as well as for private and municipal plants. The map was prepared by the College of Engineering, State University of Iowa; additional copies may be obtained from the Iowa Committee on Public Utility Information, 310 Crocker Building, Des Moines.

Electric Investors to Split Stock

Electric Investors, Inc., is planning to split its common shares five for one at an early date. On April 30 there were 948,119 shares outstanding, of which the Electric Bond & Share Company owned 13 per cent, so that approximately 4,750,000 new shares would be outstanding following the split-up. The present authorized issue of common stock is 2,000,000 shares of no par value and the company also has an authorized issue of 1,150,000 $6 preferred shares, of which 240,000 shares are outstanding.

United Corporation Gives Rights for Common

Stockholders of the United Corporation at a special meeting held July 10 voted to increase the authorized capital from 10,000,000 to 24,000,000 no par common shares and from 2,000,000 to 5,000,000 preference shares in order to raise funds for the offering of additional stock and to permit further expansion of the company. Application was made for the listing of 1,344,312 additional common shares and 23,032 additional $3 preference shares. Of the additional shares, 1,153,253 common shares are being offered to stockholders of record of July 10 for subscription at $37.50 a share until Aug. 15, while 191,059 common and 23,032 preference shares will be used in exchange for certain securities to be acquired by the company.

New Capital Issues

Central States Power & Light Corporation Preferred Stock.

Amount, 20,000 shares.
Price, $95 and accrued dividend to yield about 7.35 per cent.
Feature, preferred as to both assets and cumulative dividends.

Central States Power & Light Corporation furnishes electric light and power and other public utility service to 122 cities and communities in Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Oklahoma and Texas. This corporation is under the management of Utilities Power & Light Corporation through that corporation's control of its common stock.

Long Island Lighting Company Preferred Stock.

Amount, $4,000,000.
Price, $100 per share and accrued dividend.
Feature, preferred as to assets and dividends over the common stock.

Long Island Lighting Company supplies, either directly or indirectly, substantially the entire electric light and power and gas service on Long Island up to the New York City Line, and in addition, the Rockaway district of the Borough of Queens. Proceeds from the sale of this preferred stock will be used by the company to reimburse it for expenditures made for additions, extensions and improvements to the properties of the company and for other corporate purposes. The preferred stock is followed by 3,000,000 shares of no par value common stock. Dividends have been paid regularly on the common stock since 1914. The common stock, based on current market quotations, has a value in excess of $200,000,000.

Cities Service Power & Light Company Gold Debentures.

Amount, $20,000,000.
Price, $93 and interest, to yield about 6 1-8 per cent.
Feature, debentures are dated June 1, 1929 to mature June 1, 1949.

Cities Service Power & Light Company, a subsidiary of Cities Service Company, controls through stock ownership companies rendering public service in seventeen states, serving territories having a population estimated to be in excess of 2,200,000. More than $15,000,000 of the proceeds from the sale of these 5½ per cent debentures will be used to provide funds, or to reimburse the company for the acquisition or retirement of funded debt or preferred stocks of subsidiaries outstanding December 31, 1928 and to retire short term indebtedness of the company.

New Production Record During June

GENERAL manufacturing operations in the United States in June, corrected for seasonal variation and based on consumption of electrical energy, were the highest on record, surpassing the previous high monthly rate, which occurred during May, by 2 per cent. Sustained activity in the metal industries, rubber manufacturing and the stone, clay and glass groups and the improvement in the forest products industry accounts for much of the gain made.

June rate of operations, not corrected for seasonal variation, was 1.2 per cent under May, but was 16.1 per cent over that reported for June last year. The first six months of 1929 witnessed an average rate of activity 13.7 per cent greater than during the same period last year.

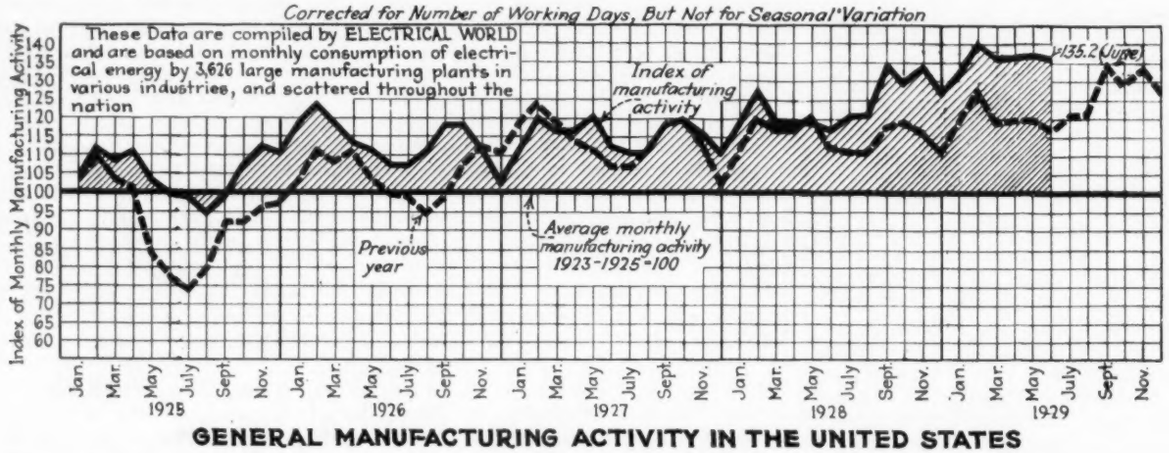
The automobile industry, including the manufacture of parts and accessories, reported a drop of about 4.8 per cent in rate of activity during June, as compared with May. June activity in these plants was on a plane about 9.7 per cent under the peak month of April, but was still operating at a rate 13.2 per cent above June, 1928, and 43.2 per cent above June, 1927. The rolling mills and steel plants recorded a drop in operations during the month of 10.4 per cent as compared with May, but were still operating on a plane 27.3 per cent above June last year. Operations in the ferrous and non-ferrous metal-working plants were slightly under those of May, but were 16 per cent above June, 1928.

Industries recording gains during June as compared with May included the chemicals and allied products group, leather products, forest products, paper and pulp, rubber products, and the stone, clay and glass groups.

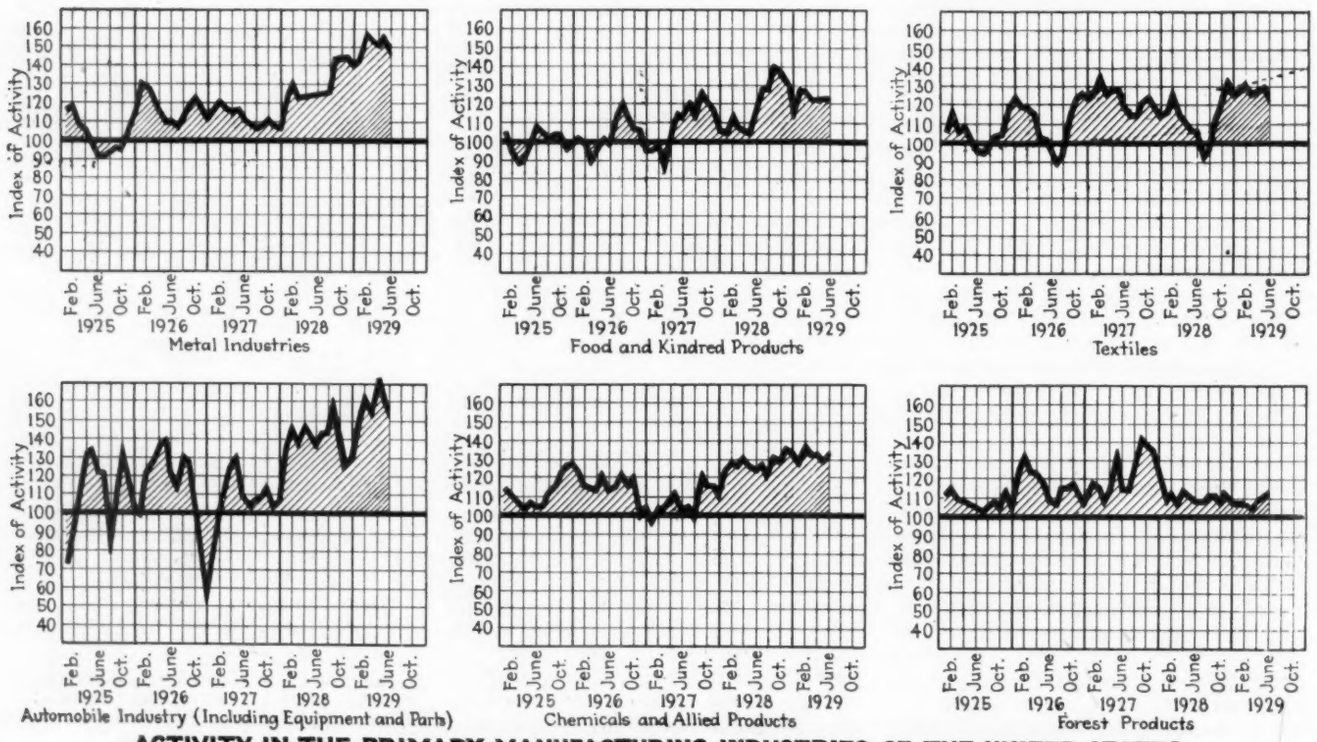
The textiles industry recorded a drop of 5.3 per cent in rate of operations during June as compared with May and was operating on the lowest plane since last October. The current June operations of these plants, however, were still 17.5 per cent above June last year, at which time industry was witnessing a decided slump.

Every industrial group, with the exception of the leather products and forest products groups, reported an average rate of activity during the first half of the current year materially above that during the same period last year, and the outlook is for a continued high rate of operations throughout the summer months, with an even higher rate of activity probable as the fall opens.

ELECTRIC VACUUM CLEANER DECLARES EXTRA DIVIDEND.—Directors of the Electric Vacuum Cleaner Company, Cleveland, at their meeting held June 26 declared the regular quarterly dividend of $1 per share on the common stock and $3 extra per share on the common stock. Dividend will be payable July 1, 1929, to stockholders of record on June 26.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of Monthly Manufacturing Activity
Index of manufacturing activity
Previous year
Average monthly manufacturing activity 1923-1925=100
135.2 (June)
Jan. Mar. May July Sept Nov.
1925 1926 1927 1928 1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

Consolidations Tend to Resist General Price Rises

CONSOLIDATIONS in the manufacturing industry have been a factor tending to resist the general upward movement of prices and in stabilizing the markets in which they operate, according to a report just completed by the National Industrial Conference Board, 247 Park Avenue, New York. Consolidations in general were found to have achieved an appreciable superiority in production over independent producers in their respective fields, although the same may or may not be true of the distributive phase of their operations which were not included in the scope of the conference board's study.

A popular impression as to the financial success of consolidations generally is proved illusory in that the study of the business history of a large number of consolidations over a period of from ten to twenty-three years prior to the war showed that, by and large, these mergers did not prove exceptionally profitable. Their combined record was found not to differ much from that of independent business concerns, in that, while many made high profits and grew in size and importance, many failed absolutely and the majority failed of conspicuous success, indicating that consolidation in itself is no substitute for business acumen or efficient management.

The effect of consolidations upon the price level is demonstrated with voluminous statistical evidence. Based upon 60 lines of manufacturing, the study discloses that the general upward trend of prices from 1900 to 1925 has been much less pronounced in those branches of manufacturing in which industrial consolidations have been a dominant factor in the market. The rise in prices in these 26 lines of manufacturing was only 28.8 per cent, as against a rise of 110.6 per cent during the same period in the 21 lines of manufacture which have not been affected by the consolidation movement. In the remaining thirteen branches of manufacture, in which consolidations of limited scope have been formed, prices during the past quarter century rose on the average 70.7 per cent. Reducing prices to dollars of equal purchasing power on a 1913 base, the disparity in price advance between the three groups is not so striking, of course, yet in the group where consolidations were dominant the price advance was approximately only one-half of what it was in the group where industries had not felt the effects of amalgamation.

As regards productive efficiency, the conference board studied eighteen branches of manufacturing, in which consolidations and independent concerns were represented in adequate numbers to allow definite conclusions, over the post-war period 1920-1926 inclusive. In nine of the eighteen branches of manufacture, technological progress was found to have been more rapid among the amalgamated enterprises than among the independents; in four others, the independents proved more efficient and in the remaining five the statistical evidence was inconclusive. In 1926, however, the last year of the period, the consolidations showed a superior productive efficiency in eleven out of the sixteen branches of the manufacturing industry then available for comparison. In one of these instances the consolidation output was 115 per cent greater per hour of labor employed than the average output of the independent concerns.

In the view of the conference board, the results of the study indicate that the improvements in productive efficiency and the stimulus to technical progress for which consolidations have been measurably responsible have brought about lower prices to consumers and steadier employment for employees, so that the public generally has shared in the economic advantages of consolidation.

Construction Ahead 31½ per Cent Over Last Year

May added $471,609,000 to the year's contract total, making it 31½ per cent larger than for the first five months of 1928, according to the *Engineering News-Record*. The weekly rate in May was $94,000,000 compared with $71,000,000 in May, 1928, an increase of 32 per cent.

The five months' total of nearly two billion dollars consists 73 per cent of private work, whereas a year ago this figure was 63 per cent. It is to be noted that total public construction this year amounts to just about the same as last year, the figures being $519,000,000 for 1929 and $533,000,000 for 1928. This 2.5 per cent decline in public lettings, though due chiefly to this season's lag in road work, is by no means confined to roads. Water-works, sewers, and public bridges are all a little behind last year's values at this time. Road lettings in May amounted to $78,000,000 compared with $45,000,000 in April, and $83,000,000 in May, 1928. Lettings to date total $183,000,000, compared with $265,000,000 a year ago, a lag of 31 per cent.

This year's increase in engineering construction, therefore, is in private work. This is the case not only for commercial and institutional buildings, but for the broad unclassified group as well. In millions of dollars, the figures for this year and last are as follows: Industrial buildings, 266 and 125; commercial buildings, 846 and 705; unclassified construction, 304 and 120.

The unclassified group includes piers, transmission lines, tunnels, playgrounds, boardwalks, stadiums, grain elevators, power developments and subways. May contracts for this group amounted to $50,000,000.

Value of Contracts by Sections in the United States and Total for Canada, May, 1929

Thousands of Dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States		Canada
							May, 1929	Jan. 1 to Date	May, 1929
Water-works	$896	$3,043	$251	$657	$319	$318	$5,484	$18,795	$797
Sewers	58	3,419	1,461	5,051	856	880	11,725	36,466	115
Bridges	352	6,723	4,758	5,307	3,975	100	21,215	60,833	507
Excavations, etc.	13	147	611	192	329	.....	1,292	16,021	78
Streets and roads	5,509	21,246	9,880	19,549	16,718	5,382	78,284	183,462	1,109
Industrial buildings	1,692	5,897	15,330	11,606	34,434	5,341	74,300	265,572	5,315
Commercial buildings	15,984	116,424	3,676	46,525	23,935	14,349	220,873	980,048	5,252
Federal government	102	2,600	3,641	63	2,102	400	8,908	44,680	.....
Unclassified	448	2,196	35,954	1,301	2,105	7,524	49,528	303,883	3,819
May, 1929*	25,054	161,695	75,562	90,251	84,773	34,274	471,609	.....	16,992
April, 1929†	23,027	138,376	42,043	51,605	33,166	27,992	316,209	.....	16,287
May, 1928*	36,903	134,896	20,445	89,537	48,916	26,362	357,059	.....	13,329
Year to date, 1929	102,618	764,051	198,584	339,816	314,089	190,602	.....	1,909,760	72,274
Year to date, 1928	102,471	552,507	109,729	338,891	211,169	135,815	.....	1,450,582	64,051

*Five weeks. †Four weeks.

Dullness in Metal Markets Continues

The quietness that has characterized the metal markets for almost every week since the first of April shows no evidence of changing in spite of the assertions made some weeks ago that buying, notably of copper, could not be postponed later than July 1. No great pressure to sell is yet in evidence, so that prices have continued firm except for the slight declines in lead, which were brought about principally by the weakness in London. Consumers seem to be waiting as long as possible before placing orders, and then only buying small quantities for immediate shipment. This gives the market a strong technical position and precludes the probability of price cutting on any extensive scale unless metal stocks should become burdensome.

NEW YORK METAL MARKET PRICES

	July 3, 1929 Cents per Pound	July 10, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	7.00	6.80
Antimony	8.625	8.50
Nickel, ingot	35	35
Zinc, spot	7.05	7.10
Tin, Straits	45.125	45.625
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price July 10, 1929, 19¼ cents.

Market Conditions

ORDERS for substation equipment and the demand for transformers and auxiliary apparatus are outstanding features throughout the Eastern district. Railway electrification in New Jersey and in the Philadelphia district is beginning to make demands upon equipment manufacturers.

——A QUIET TONE PREVAILS IN BUYING in the New England district.

——LINE EXTENSION AND CIRCUIT REVISION WORK IS ACTIVE in the Middle West. Business continues good in the St. Louis district.

——THE VOLUME OF BUSINESS CONTINUES SATISFACTORY in the Southeast. Orders were placed for lightning arresters, transformers, poles and other equipment.

——LARGE ORDERS FOR WIRE AND MACHINERY, mainly from power companies, are reported on the Pacific Coast. In the Puget Sound area industrial business is light.

EASTERN DISTRICT

Central stations are in the market for substation equipment in the Eastern district and the demand for transformers and auxiliary apparatus is an outstanding feature of current sales. Inquiries are holding up well in this line and the prospects for a heavy volume of commitments are encouraging. A metropolitan power company has placed an order for transformers and switching equipment with a state manufacturer to cost $75,000. A northern New York central station has purchased similar apparatus, including regulators, totaling $100,000. A Carolina power utility has contracted for transformers and accessories to an amount of $75,000, and a Connecticut central station has given a commitment for a transformer unit, regulators, miscellaneous switchgear and auxiliary equipment to cost $115,000. While prime movers are securing spotty attention, a fair amount of business is being transacted for this season of the year. A New York manufacturer will furnish two 10,000-hp. steam-turbo-generating units for a central station in Texas, the condensing apparatus being supplied by a Pennsylvania maker. A power company in Virginia has placed an order with a Chicago manufacturer for a Diesel engine-generating set.

Marine and railroad accounts are growing factors in the demand for heavy equipment. With the award of contracts by the Navy Department, Washington, for the construction of the first five of the fifteen-cruiser program authorized by Congress, early activity is expected in connection with machinery demands. Each vessel will be of 10,000 tons rating, with length of about 600 ft. over all, and 65-ft. beam, and will develop 100,000 hp. One will be built at the New York Shipbuilding Company yard of the American - Brown - Boveri Corporation at Camden, N. J. Railway electrification in New Jersey and in the Philadelphia district is beginning to make demands upon equipment manufacturers. A New York maker has secured a contract for oil-electric locomotives for an Illinois railroad to cost $300,000. A manufacturer of motors reports a brisk demand for units for ventilating and general-purpose service in metropolitan theaters and a strong call for ice and refrigerating plant installations. A Philadelphia maker of Diesel engine-generating sets has secured a contract for a 350-hp. unit for a New York hotel. A producer of insulators for high-tension service says that there is a fair demand for units for outdoor purposes. There is keen competition in connection with steel transmission towers, and a recent order for 2,000 tons for a South American power company has been placed with a Pacific Coast fabricating plant. Construction projects are as follows:

Aviation Consolidated, Inc., Lake Placid, N. Y., plans a floodlighting system at its proposed airport, to cost $100,000. The Universal Wireless Communication Company, Buffalo, N. Y., plans a transmitting station, with towers and a power plant at Akron, N. Y., to cost $100,000. The Marcellus Casket Company, Syracuse, N. Y., plans an addition to cost $100,000. The Lionite Abrasive Company, a subsidiary of the General Abrasive Company, Niagara Falls, N. Y., plans a plant at Niagara Falls, Ont., to cost $125,000. The Pioneer Instrument Company, Brooklyn, will make extensions at its aircraft instrument plant to cost $70,000. Otto S. Schlich, New York, engineer, is preparing plans for a cold storage and refrigerating plant at North Bergen, N. J., to cost $75,000. Hobart College, Geneva, N. Y., plans a science building to cost $450,000. Middletown, N. Y., contemplates a floodlighting system at its proposed municipal airport. The John A. Roeblings Sons' Company, Trenton, N. J., will build an addition to its wire and cable mill to cost $125,000. The Delaware, Lackawanna & Western Coal Company, New York, will build a coal storage and distributing plant at Jersey City, N. J., to cost $250,000. The Atwater Kent Manufacturing Company, Philadelphia, will build a power plant at its radio equipment factory to cost $250,000. The Pittsburgh Plate Glass Company, Pittsburgh, plans additions to its plant at Newark, N. J., to cost $175,000. The American Analine Products Company, Lock Haven, Pa., plans an addition to its chemical factory to cost $180,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., will build a power substation at Annapolis, Md. The General Purchasing Officer, Panama Canal, Washington, will receive bids until July 24 for refrigerating equipment (Panama Schedule 1975). The Village Board, Albion, N. Y., will open bids July 22 for alterations and extensions to its municipal sewage disposal plant for which a bond issue of $50,000 has been voted; John F. Skinner, Rochester, is engineer. The Buffalo Foundry & Machine Company, Buffalo, N. Y., plans an addition to its plant on Fillmore Avenue to cost $30,000. The Jamestown Telephone Corporation, Jamestown, N. Y., plans new automatic telephone branch exchanges in Lakewood, Bemus Point and Frewsburg, N. Y., to cost $180,000, and will connect Lakewood and Jamestown exchanges with an underground cable system. The company also is changing its main system at Jamestown to automatic dialing.

NEW ENGLAND

Less activity in buying is reported in the New England district. Orders for heavy equipment slackened, but a steady trend was noted in the movement of small industrial motors and switch and control equipment. Central-station equipment orders receded. New construction supplies are active and pole line equipment, including poles, wire and line hardware, is moving well. Wiring devices are in active demand, while interior electric lighting

units are selling well and armored cable orders are heavy. Industrial requirements are confined to specialties, of which are noted a good demand for small electric heating units. Electric-power-driven tools for contractors are attracting interest and sales exceed the volume reported for last year for the first half of the year. Electric merchandising is holding up well, range sales are active in southeastern Massachusetts, refrigerator sales are steady and small appliance sales show gains over last year to date. Construction projects are as follows:

The Rising Paper Company, Housatonic, Mass., will build an addition to its mill at Great Barrington, Mass., to cost $85,000. The Moth Aircraft Corporation, South Lowell, Mass., plans expansions to cost $100,000. The State Airport Commission, Providence, R. I., plans a floodlighting system and beacon lamps at its proposed airport to be located at Hillsgrove, R. I., to cost $150,000.

Middle West

General business in the Middle West continues on an even and satisfactory basis. Railroad equipment and maintenance purchasing has been particularly heavy during the first half of the year with no apparent signs of an immediate let up. The utility companies are devoting a great deal of attention to line extension and circuit revision work, while plant extension construction work is particularly dull. The demand for major apparatus is comparatively light, although considerable purchasing of distribution equipment is going on continuously. Some of the interesting orders placed include three transformers of 7,500-kva. O.I.W.C. and 5,000-kva. S.C. 55 deg. rise, three-phase, 60-cycle, 12,000-4,000 volt, low winding divided in two equal parts that may be loaded independently or in parallel with each other, six 500-kva., six 667-kva. and three 883-kva. O.I.W.C. 12,000-volt, single-phase, 60-cycle transformers, one 30,-000-C.F.M. up-blast discharge blower, several orders for wires and cables valued at $35,000, and several construction orders aggregating $75,000. Jobbers' sales are normal for this time of the year. There has been an excellent demand for electrical refrigerators, fans and hot weather appliances. Construction projects are as follows:

The Ambrosia Chocolate Company, Milwaukee, Wis., plans a factory to cost $100,000. The Lakeside Bridge & Steel Company, Milwaukee, Wis., plans an addition to cost $50,000. The Murray Body Corporation of America, Inc., Detroit, plans an addition to its power plant at Bay City, Mich., to cost $40,000. The Department of Public Lighting, Detroit, plans an equipment storage and distributing plant to cost $150,000. The International Aircraft Company, Oncor, near Cincinnati, Ohio, plans a plant at Jackson, Mich., to cost $100,000. The Olds Motor Works, Lansing, Mich., plans an addition to cost $400,000. The Auto Specialties Manufacturing Company, St. Joseph, Mich., will build an addition to cost $150,000. The Anton Clemetson Company, Chicago, plans an addition to its office furniture factory to cost $65,000. The R. H. Buhrke Company, Chicago, will build an addition to its golf club factory to cost $70,000. Benjamin Moore & Company, Chicago, plans a paint and varnish factory to cost $150,000. The Kewanee Manufacturing Company, Kewanee, Ill., will build an addition to its laboratory equipment factory to cost $70,000. The Lake Shore Cleaners & Dyers, Inc., Wilmette, Ill., plans an addition to cost $90,000. The Public Service Company of Northern Illinois, Chicago, plans a substation at Wilmette, Ill., to cost $65,000. The Union Drawn Steel Company, Gary, Ind., plans an addition to cost $85,000. The Warner Gear Company, Muncie, Ind., plans an addition to cost $100,000. The State Department of Public Welfare, Columbus, Ohio, will receive bids until July 18 for a power plant and equipment at the Institution for Feeble Minded, Apple Creek, Ohio. The Timken Roller Bearing Company, Canton, Ohio, will build an addition to cost $200,000. The Cleveland Electric Illuminating Company, Cleveland, will build a power substation to cost $260,000. The Ford Motor Company, Highland Park, Detroit, will make extensions in its assembling plant at Cleveland, Ohio, to cost $200,000. The Potters' Supply Company, East Liverpool, Ohio, plans an addition to cost $80,000. The Webb Publishing Company, St. Paul, Minn., plans a printing plant to cost $130,000. Creighton University, Omaha, Neb., plans a power plant to cost $150,000. Cedar Rapids, Iowa, plans extensions in its street lighting system. The International Harvester Company, Chicago, plans a factory branch at Fort Dodge, Iowa, to cost $150,000.

Southeast

A satisfactory volume of business is reported for the Southeast, but no individually large orders are being placed. A Georgia company ordered lightning arresters amounting to $12,500 and a South Carolina central station ordered three 500-kva. transformers. Two satisfactory creosoted pine pole orders were placed by Georgia companies, one amounting to $8,000, while the other was for $3,000. An Alabama company has just completed an electric refrigerator campaign in which 1,038 units, selling for $342,000 were placed. Two Georgia textile plants placed orders for loom motors, one order being for $7,000 and the other for $5,000. Radio amplifying systems seem to be in active demand among the hotels of this section, the most recently reported being installations for Georgia and Alabama, costing $9,000 and $7,500 respectively. Another Georgia hotel placed an order for 100 ceiling fans costing in excess of $3,000. The Georgia Power Company has purchased the municipal electric distribution system in Jonesboro, Ga., which system has heretofore been a wholesale power customer of the power company. Construction projects are as follows:

The Chesapeake & Ohio Railway Company, Richmond, Va., plans shop additions at Hinton, W. Va., to cost $120,000. The Appalachian Electric Power Company, Bluefield, W. Va., will install an ornamental lighting system at Huntington, W. Va. The Vitrolite Company, Chicago, contemplates additions to its artificial marble plant at Parkersburg, W. Va., to cost $75,000. The University of Tennessee, Knoxville, Tenn., plans an engineering building to cost $200,000. High Point, N. C., contemplates a municipal electric light and power plant to cost $50,000. The Beacon Manufacturing Company, Swannanoa, N. C., plans additions to its textile mill to cost $400,000. Montgomery, Ala., plans a floodlighting system and beacon lamps at its municipal airport. The St. Louis-San Francisco Railway Company, St. Louis, will make extensions in terminals, shops and other buildings at Pensacola, Fla., to cost $800,000.

St. Louis District

There has been no marked change in business conditions in the St. Louis district, but the general tone continues good. The following contracts have been reported closed during the past week. A 3,500-kw. turbo-generator unit costing $53,000, a bank of transformers for a rotary converter, costing $6,000, a lot of motors with control, costing $12,000, an addition to a manufacturing plant in Illinois, including motors, switching equipment, conduit and fittings, costing $16,000, and a substation structure and high-tension switching equipment for a power distributing company costing $11,000. Construction projects are as follows:

The Main Street Lighting Corporation, Kansas City, Mo., plans an ornamental lighting system. The Missouri Power & Light Company, Jefferson City, Mo., plans a transmission line to New Bloomfield, Ashland, Mo., and vicinity, to cost $50,000. Pecos, Tex., plans a floodlighting system and beacon lamps at its proposed municipal airport to cost $85,000. The Southern Air Transport, Inc., Fort Worth, Tex., plans an aircraft plant near San Antonio, Tex., to cost $100,000. The West Texas Utilities Company, Abilene, Tex., plans extensions in the transmission lines at Turkey, Tex., and vicinity. The New Orleans Public Service, Inc., New Orleans, La., plans an equipment storage and distributing plant to cost $90,000.

Pacific Coast

Large orders for wire and machinery, mainly for power companies, continue to feature the Pacific Coast business. The Pacific Gas & Electric Company is in the market for $100,000 worth of 750,000-circ.mil three-conductor, 11,000-volt paper and lead sector cable. The Great Western Power Company has bought $12,000 worth of bare copper and $15,000 worth of weatherproof wire and the San Joaquin Light & Power Company has ordered $17,000 worth of bare copper wire. The power company machinery orders include $60,000 worth of Westinghouse automatic switching equipment for the Chico, Calif., district, $15,000 worth of transformers for southern California and $160,000 worth of miscellaneous Westinghouse equipment for a Butte, Mont., company. The prospective machinery business now being figured covers approximately $250,000 worth of circuit breakers, $500,000 worth of transformers and about $750,000 worth of

machinery. The latter being chiefly for the Mokelumne project. Industrial business covers a $25,000 General Electric automatic elevator equipment for the new stock exchange, $25,000 worth of generators and switchboards for an Arizona mine and a 200-kva. Westinghouse generator and switchboard for another. Dealers' business is good with many jobs awarded and conduit business has been very heavy. The Madera irrigation district is surveying properties with the intention of constructing a steam auxiliary plant and transmission line and another considerable public project proposed is the $4,000,000 tunnel connecting Alameda and Contra Costa counties with elaborate lighting, signaling and ventilation electric systems. The Westinghouse company was awarded a southern Pacific lamp contract, totaling about $125,000, for large and miniature lamps.

Industrial buying continues light with orders from lumber mill and allied woodworking plants at minimum in the Puget Sound district. Central-station buying in the Seattle district was confined to the usual orders of meters and small transformers. The Pacific Electric Manufacturing Corporation sold $10,000 worth of 73,000-volt gang-operated disconnecting switches for installation at the New Ruskin development to the British Columbia Electric Railway Company, Ltd., at Vancouver, B. C. An order for about $150,000 worth of rotating equipment, switchboards, etc., for this installation was placed with the Canadian Westinghouse Electric & Manufacturing Company. An order for about $25,000 worth of porcelain for a 30-mile extension to the transmission line of the Grays Harbor Railway & Light Company at Aberdeen, Wash. was placed with the Graybar Electric Company and pole line hardware, approximating $5,000 is expected to be placed shortly.

The board of contracts and awards at Tacoma, Wash., is taking bids until August 5 for about $60,000 worth of gang-operated disconnecting switches, lightning arresters, choke coils, etc., for the Lake Cushman Hydro-Electric Unit No. 2. The Pacific Telephone & Telegraph Company during the latter part of July will start work on a project involving two additional long-distance telephone circuits between Seattle, Wash., and Victoria, B. C. Negotiations were reopened between the officials of the Puget Sound Power & Light Company and the city commissioners of Everett, Wash., for development of the Sultan River power and water project to cost $16,000,000. An ornamental street-lighting system in Portland costing in excess of $45,000 is about to be started. Construction projects are as follows:

The Pacific Gas & Electric Company, San Francisco, plans a power substation at Diamond Spring, Calif., to cost $30,000. The Detroit Aircraft Corporation, Detroit, Mich., contemplates a plant at Long Beach, Calif., to cost $100,000. The Phillips & Van Orden Company, San Francisco, plans a printing plant to cost $200,000. The American Can Company, San Francisco, plans an addition to its plant to cost $100,000. Santa Rosa, Niles, Richmond, Inglewood and Monterey, Calif., and Anaconda, Mont., plan ornamental lighting systems. Walla Walla, Wash., plans a flood-lighting system and beacon lamps at its municipal airport to cost $50,000. Mount Pleasant, Utah, plans a municipal electric light and power plant to cost $40,000. The American Beet Sugar Company, Denver, Colo., will build an addition to its mill at Rocky Ford, Colo., to cost $100,000.

Activities of the Trade

Two Refrigerator Firms in Merger

The Absopure Refrigeration Corporation has been formed and has acquired all the assets of the Absopure Frigerator Company of Detroit and the Vogt Refrigerator Company of Louisville, Ky. Both of these companies were formerly operated as divisions of the General Necessities Corporation, of which David A. Brown is president. Mr. Brown also is president of the Absopure Refrigeration Corporation.

The corporation operates two plants, one in Detroit, where a complete line of electric refrigeration machines and all accessories are manufactured, and one in Louisville, Ky., producing metal refrigerators, water coolers and all metal parts.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Carnegie Steel Company for approximately 385 hollow square busbar supports. This support is particularly adopted to heavy, low-voltage bus construction, to support 4x½-in. bars and for a maximum of 4,000 volts alternating current or direct current.

THE HANSON-VAN WINKLE-MUNNING COMPANY, Matawan, N. J., manufacturer of electroplating and polishing equipment and supplies, announces that H. R. Smallman, for the past three years assistant to the sales manager, has been made manager of its Chicago office with headquarters at 549 West Washington Boulevard. H. M. Cherry, who for the past seven years has represented the company in Michigan, has been made manager of the Detroit office with headquarters at 5415 Twelfth Street, and Louis M. Hague, who for the past two years has represented the company in western Pennsylvania, has been made manager of the Pittsburgh-Cleveland office with headquarters at 106 Liberty Avenue, Pittsburgh, the territory comprising Ohio, western Pennsylvania and West Virginia.

THE COMBUSTION ENGINEERING CORPORATION, 200 Madison Avenue, New York City, announces that its territory previously known as the Atlanta district has been divided into three sections, served by offices located in Charlotte, N. C.; Atlanta, Ga., and New Orleans, La. T. W. Battle has been appointed district manager of the Charlotte territory, with offices at 919 Johnston Building. I. S. Forde has been appointed acting district manager of the Atlanta territory with offices at the Candler Building and E. C. Walthall has been appointed district manager of the New Orleans territory, with offices at 1118 Union Idemnity Building.

Claude Neon U nits in South Merge

The formation of a new company to manufacture and distribute Claude Neon lights in the Southern states has been announced. This new company represents a merger of the Southern interests of Claude Neon Lights, Inc., with the Elliott Claude Neon Lights of Florida and the Munn Sign & Advertising Company of Atlanta.

The name of the new company will be the Claude Neon Southern Corporation, which will be licensed under the various patents of Georges Claude for the states of Alabama, North Carolina, South Carolina, Georgia and Florida. R. L. Kester, Jr., vice-president of Claude Neon Lights of New York, will be president of the new company. The vice-presidents will be E. Frank Munn, Clark B. Davis and E. B. Elliott.

The Claude Neon Southern Corporation will obtain the business of the two Florida factories at Miami and Tampa and will secure the Atlanta plant of the Munn Sign & Advertising Company, which has been operating at capacity to serve the states of Georgia and Alabama, North Carolina and South Carolina. Plans have been approved for the enlarging of the Atlanta plant and the establishment of new factories in Alabama and the Carolinas.

THE COPPERWELD STEEL COMPANY, Glassport, Pa., announces the establishment of a northeastern district under the management of George F. Bain. The northeastern district includes all of the New England states and all of New York state north of Westchester and Rockland counties. Mr. Bain's headquarters will be at 30 Church Street, New York City. Paul Van Wagner is now district manager for Greater New York City and for New Jersey, Pennsylvania and West Virginia, with offices at 30 Church Street, New York City.

New Equipment Available

Modified Type 15-Amp. Circuit Breaker

Following the announcement of the new "Deion" circuit breaker principle at the January meeting at the A.I.E.E., the Westinghouse Electric & Manufacturing Company has placed on the market a new 15-amp. breaker based on the "Deion" principle. This device replaces the conventional panelboard toggle switch and fuse, doing more satisfactory work than either. The cost and trouble of fuse replacements are entirely eliminated, because when an abnormal overload occurs on a branch circuit the breaker opens automatically and it can be immediately reclosed providing the overload condition is not sustained. The automatic mechanism trips free from the handle so that the contact cannot be held closed against the abnormal overload or short circuit.

The circuit breaker consists of a rugged toggle mechanism actuating the moving contacts and insuring full contact pressure up to the time of opening, whether actuated automatically or manually. The automatic release is secured through the action of the bimetallic thermal element which engages the releasing latch of the mechanism. The bimetallic material has been selected with great care to insure a constant calibration and it will withstand short circuits far in excess of actual requirements. The high rupturing ability of the automatic circuit breaker is secured through the application of the "Deion" principle.

The thermal release element is so designed as to give desirable inverse time limit characteristics. For instance, the circuit breaker will carry 10 per cent above normal indefinitely without tripping, but when the current reaches 50 per cent above normal the circuit breaker trips in less than two minutes. At higher overloads the time limit becomes less and less until instantaneous tripping is secured.

Improved Pressure Governor

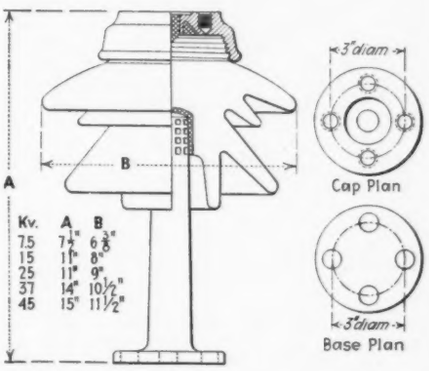
An improved design of its CR-2922 pressure governor, designed as form B-1, is announced by the General Electric Company. The changes result in improved appearance, greater strength of some vital parts, simplification and generally better electrical design.

To increase the reliability of the governor the impulse type relay has been replaced by a potential relay. On low pressure the relay is energized and remains energized through the holding interlock until the relay coil is shorted out on high pressure through a series resistance. The contact and gage mechanism has been made very rugged and special provision has been made to prevent the gage mechanism from getting out of alignment with the contact mechanism. The Bourdon tubes on gages 300 lb. rating and below are mounted two in parallel, one actuating the needle and the other the contact mechanism. This insures accuracy in operation and indication.

Another improvement is by allowing the incorporation of gages in sizes up to 10,000 lb. The limit in the former design was 800 lb.

Interchangeable Switching and Bus Support Caps

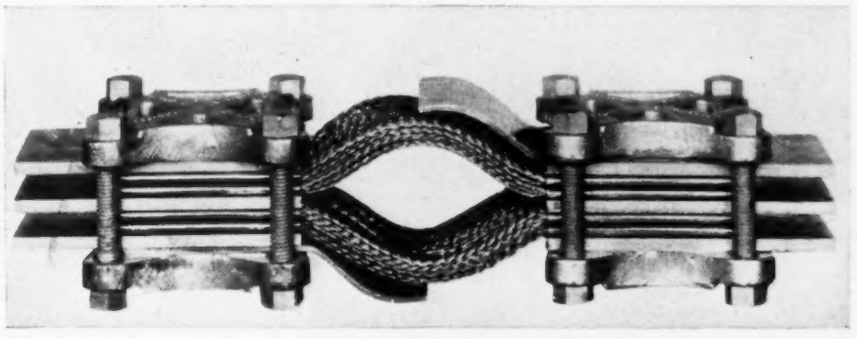
A new line of high-strength interchangeable switching and bus support cap and pin insulator units with 3-in. bolt circles is announced by the Champion Switch Company, Kenova, W. Va. These units have a wide application on outdoor substation switching and protective equipment.



Kv.	A	B
75	7½"	6⅜"
15	11"	8"
25	11"	9"
37	14"	10½"
45	15"	11½"

Expansion Joints for Buses

Flexible joints that can be bolted directly to the busbars or clamped as desired are announced by the Delta Star Electric Company, Chicago. Frequently bus support failures can be traced to short-circuit stresses, vibration, elongation due to expansion or disalignment, etc. Guards are provided in this product to retain the flexible braids during short circuits, thereby not endangering flashover distances.



Heater for Warming Airplane Engine Oil

A new electric heating unit designed especially for warming the engine oil of aircraft to facilitate quick starting, especially in cold weather, is announced by the General Electric Company. The unit will operate from the local electric lighting circuit in the hangar.

When planes are stored in unheated hangars it has been customary during cold spells to drain the lubricating oil from the oil tank after flying operations in the evening and to preheat the oil in the morning.

The new electric heating unit consists of two 110-volt, 375-watt heating units conveniently shaped to fit into the conventional aircraft oil tank by insertion through the filter cap. Three degrees of heat are provided. The units can be operated in series for low heat intensity, they can be used as a single unit for intermediate intensity and they can be operated in parallel for high intensity. The corresponding wattage values are 187, 375 and 750 respectively at 110 volts.

Gas-Engine-Driven Arc-Welding Set

A 300-amp. gas-engine-driven, single-operator arc-welding set is announced by the Westinghouse Electric & Manufacturing Company. The complete set consists of the model P-35 Continental four-cylinder gas engine direct connected to a new type Westinghouse 300-amp., single-operator type SK arc-welding generator with flexibly coupled exciter overhung from the generator bracket. The generator has a special bracket which fits into the engine housing so as to make the complete equipment as compact as possible. The generator control panel is mounted on top of the generator frame and fully enclosed by a sheet metal cabinet. The welding current is varied over the entire range by means of a single dial rheostat.

Protective covers over generator, commutator and engine hood make the complete equipment suitable for service in all weather conditions without the use of a canopy. The set can be made portable by the addition of running gear parts and it is separately excited, resulting, it is claimed, in simplified control and efficient operation.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 2, 1929)

17,357 (reissue). PIEZO-ELECTRIC RESONATOR; W. G. Cady, Middletown, Conn. App. filed Aug. 6, 1925.

1,718,957. RHEOSTAT; F. F. Hillix, Cleveland, Ohio. App. filed Nov. 25, 1922.

1,718,970. ELECTRIC HEATER FOR HOT-WATER SYSTEMS; S. J. Lonergan, La Porte, Ind. App. filed Oct. 22, 1927.

1,718,973. MAGNETO-ELECTRIC GENERATOR; E. B. Nowosielski, Bloomfield, N. J. App. filed Sept. 28, 1926.

1,718,980. THERMOSTATIC CONTROL FOR GENERATORS; C. Ringwald, Chicago, Ill. App. filed Aug. 8, 1923.

1,719,049. IGNITION SWITCH; J. A. Forsberg, Chicago, Ill. App. filed April 19, 1926.

1,719,058. INDUCTION MOTOR; W. Koenig, Springfield, Ill. App. filed May 14, 1928.

1,719,067. MANOMETER; H. Martin, Portsmouth, England. App. filed Jan. 5, 1925.

1,719,085. BURGLAR-ALARM SWITCH; G. E. Samsel, Melvern, Kan. App. filed Aug. 22, 1927.

1,719,086. SWITCH CONTROL SYSTEM; W. M. Scott, Tredyffrin Township, Chester Co., Pa. App. filed Oct. 25, 1927.

1,719,089. ELECTRICAL APPARATUS; F. F. Starr, Dayton, Ohio. App. filed Feb. 24, 1923.

1,719,096. ELECTRIC SWITCH; A. W. Burke, Long Island City, N. Y. App. filed Nov. 24, 1925.

1,719,098. PORTABLE LAMP; A. J. Carmichael and O. Balzano, New Haven, Conn. App. filed Sept. 15, 1927.

1,719,102. ENGINE-STARTING APPARATUS; E. Dickey, Dayton, Ohio. App. filed July 30, 1925.

1,719,112. WELDING GENERATOR; C. J. Holslag, South Orange, N. J. App. filed Feb. 26, 1926.

1,719,113. WELDING TOOL; C. J. Holslag, South Orange, N. J. App. filed Feb. 29, 1928.

1,719,114. IGNITER FOR SINTERING MACHINES; R. W. Hyde, Summit, N. J. App. filed May 21, 1927.

1,719,115. MAGNETICALLY-OPERATED DEVICE; H. D. James, Edgewood, Pa. App. filed Nov. 7, 1927.

1,719,141. ELECTRICAL APPARATUS; W. H. F. Schmieding, Dayton, Ohio. App. filed March 30, 1926.

1,719,179. RESISTANCE DEVICE; H. T. Hayden, Jr., New York, N. Y. App. filed July 19, 1926.

1,719,192. ELECTROMAGNET COIL, BOBBIN AND CORE; J. Osborn, Salt Lake City, Utah. App. filed Nov. 1, 1927.

1,719,204. STORAGE BATTERY AND PROCESS FOR MAKING SAME; H. B. Tefft, Chicago, Ill. App. filed Dec. 23, 1922.

1,719,226. ELECTRIC DRIVE; C. A. Herman, Stratford, Conn. App. filed Oct. 31, 1927.

1,719,228. CIGAR LIGHTER; A. F. Langos, Chicago, Ill. App. filed Nov. 28, 1927.

1,719,241 and 1,719,242. COIL CONSTRUCTION; B. R. Scott, Woodlynne, N. J. Apps. filed Feb. 19, 1926.

1,719,266. ELECTRIC LOG; H. Hersh, Milwaukee, Wis. App. filed Sept. 26, 1928.

1,719,298. CONDENSER; A. M. Knudsen, Oak Park, Ill. App. filed June 7, 1926.

1,719,299. ENGINE STARTER; R. P. Lansing, Montclair, N. J. App. filed Dec. 16, 1925.

1,719,301. COVER; G. R. Metcalf, Jr., Erie, Pa. App. filed April 21, 1927.

1,719,302. CIRCUIT MAKER AND BREAKER; E. A. Meyer, Springfield, Ohio. App. filed May 24, 1927.

1,719,318. BOX SUPPORT; S. N Buchanan, New York, N. Y. App. filed July 16, 1927.

1,719,356. PHASE MODIFIER; H. Benioff, Pasadena, Calif. App. filed Feb. 24, 1927.

1,719,363. ATTACHMENT-PLUG RECEPTACLE; A. C. Gaynor, Bridgeport, Conn. App. filed July 9, 1927.

1,719,396. PAGING SYSTEM; J. Duross, Roxbury, Mass. App. filed Nov. 29, 1924.

1,719,401. LAMP; H. Plaut, New York, N. Y. App. filed April 1, 1929.

1,719,407. DYNAMO CLEANING AND COOLING DEVICE; J. F. Trudeau, Bayonne, N. J. App. filed Feb. 1, 1928.

1,719,445. AMPLIFYING SYSTEM; B. Olney, Rochester, N. Y. App. filed Aug. 3, 1925.

1,719,465. MEASURING INSTRUMENT; A. M. Curtis, East Orange, N. J. App. filed April 23, 1923.

1,719,471. CONTROL AND SUPERVISORY SYSTEM; H. L. Hoffmann, East Orange, N. J. App. filed Nov. 26, 1921.

1,719,491 and 1,719,492. ELECTRIC REGULATOR; H. M. Stoller, Mountain Lakes, N. J. Apps. filed June 21, 1927, and Jan. 25, 1928.

1,719,495. OSCILLATING GENERATOR; F. M. Wiese, Elizabeth, N. J. App. filed Feb. 27, 1926.

1,719,506. SUPERVISORY SYSTEM; J. C. Field, Orange, N. J. App. filed Nov. 13, 1925.

1,719,556. ELECTRICAL INDICATING INSTRUMENT; W. C. McCoy, Cleveland, Ohio. App. filed June 30, 1927.

1,719,558. ELECTRIC-ARC FURNACE; O. L. Mills, Los Angeles, Calif. App. filed March 5, 1929.

1,719,559. PULL SOCKET; H. J. Morey, Syracuse, N. Y. App. filed Oct. 13, 1924.

1,719,563. CIRCUIT-CONTROL MECHANISM; S. Seaberg, Moline, Ill. App. filed Dec. 15, 1924.

1,719,574. CONTROL MECHANISM; E. J. Vallen, Akron, Ohio. App. filed July 30, 1925.

1,719,600. VARIABLE CONDENSER; W. J. Dow, Washington, D. C. App. filed March 25, 1925.

1,719,655. INCUBATOR ALARM; E. G. Farson, Greencastle, Mo. App. filed April 2, 1924.

1,719,672. AUTOMATIC FIRE ALARM; F. F. Randolph, Fiskdale, Mass. App. filed April 6, 1927.

1,719,710. TOASTING DEVICE; G. G. Matthews, Minneapolis, Minn. App. filed Oct. 26, 1927.

1,719,722. ELECTRIC HEATER; C. F. Peterson, New York, N. Y. App. filed March 2, 1928.

1,719,761. MOTOR; A. F. Godefroy, Mexico, Mex. App. filed Feb. 23, 1927.

1,719,779. ELECTRIC-LAMP SOCKET; A. H. Nero, West Hartford, Conn. App. filed May 1, 1925.

1,719,786. METHOD FOR THE LOCATION OF OIL-BEARING FORMATION; C. Schlumberger, Paris, France. App. filed Aug. 18, 1926.

1,719,805. ALTERNATING-CURRENT CLOCK; L. Hammond, Winnetka, Ill. App. filed May 20, 1929.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Liverpool, England (No. 39,323), for advertising signs and accessories and another (No. 39,316), for storage batteries.

Purchase is desired in Prague, Czechoslovakia (No. 39,324), of insulated cables for automobiles.

Purchase is desired in Santa Marta, Colombia (No. 39,385), of electric coffee roasters and grinders.

An agency is desired in Hamburg, Germany (No. 39,321), for double contacts for electric irons.

Purchase or agency is desired in Prague, Czechoslovakia (No. (39,318), for dental X-ray apparatus.

An agency is desired in Para, Brazil (No. 39,325), for electric floor-scrubbing machines.

An agency is desired in Winnipeg, Canada (No. 39,322), for alternating current generators for power plants.

Purchase or agency is desired in Adelaide, Australia (No. 39,326), for electric central heating.

An agency is desired in Montreal, Canada (No. 39,403), for electric hoists.

Purchase is desired in Milan, Italy (No. 39,320), of household electrical appliances.

Purchase or agency is desired in Winnipeg, Canada (No. 39,319), for domestic lighting fixtures.

Purchase and agency are desired in Nantes, France (No. 39,330), for vacuum cleaners.

New Trade Literature

INDICATOR.—A folder issued by the Combustion Engineering Corporation, 200 Madison Avenue, New York City, describes and illustrates the C-E water level indicator, a device for indicating the water level in the boiler at the eye level of the operator.

ELECTRICAL PRODUCTS.—The Benjamin Electric Manufacturing Company, Des Plaines, Ill., has published supplement No. 1 to catalog 24, which contains complete descriptions, listings, illustrations and installation data on its sign reflector, the new type 79 glassteel diffuser, "Sturdox" fixtures, removable reflector holders, vaporproof projectolite, intensifier, portable inspection-lite, new dust-tight glass cover, concentrating type unit, gymnasium fixture, 45-deg. ball fixture aligner, motor driven signals, new super-sensitive relay and the stand lamp vase adapter.

REGULATORS.—The Bailey Meter Company, 1050 Ivanhoe Road, Cleveland, is distributing bulletin No. 82 describing and illustrating the Bailey thermo-hydraulic feed water regulators.

LIGHTNING ARRESTERS. — Booklet No. 271 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, entitled "Preferred," is the ninth of a series describing the technical and practical features of the crystal valve lightning arrester.

MOTORS, LINE STARTERS AND LINE-START MOTORS.—Leaflet No. 5188 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers its direct-current totally inclosed fan-cooled type SK motor. The company also is distributing a special publication No. 1842 entitled "Power at the Touch of a Button," which describes line starters and line-start motors and their application to modern industries. The booklet explains the line starter principle, which permits motor control at the push of a button, and the line-start motor, which may be started across the line without the use of the line starter if high starting current is not objectionable. Numerous illustrations also are included.

ELECTRIC PERCOLATOR.—The Armstrong Electric & Manufacturing Corporation, Huntington, W. Va., is distributing a folder describing and illustrating the new Armstrong fully automatic electric percolator.

DRILLS.—The Ingersoll-Rand Company, 11 Broadway, New York City, is distributing a bulletin covering the "Calyx" core drills for determining the character, order, thickness and extent of materials below or above the earth's surface by means of cylindrical cores, which the drills extract. They are used principally for mining, quarrying, soundings, oil and water wells, road pavement testing and for drilling large diameter holes with accuracy. The bulletin is well illustrated and gives complete details of the various sizes and types of drills and general data on the subject of core drilling.

STOKERS. — A catalog issued by the American Engineering Company, Aramingo Avenue and Cumberland Street, Philadelphia, describes and illustrates its new type high capacity "Taylor" stokers for the Delray No. 3 station of the Detroit Edison Company.